“Financial infrastructure and new business density in transition economies: Resource dependence and the structural role of transport connectivity”

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FINANCIAL INFRASTRUCTURE AND NEW BUSINESS DENSITY IN TRANSITION ECONOMIES: RESOURCE DEPENDENCE AND THE STRUCTURAL ROLE OF TRANSPORT CONNECTIVITY

Abstract

In transition economies, the contribution of financial and transport infrastructure to new firm formation remains a first-order public-finance question. This paper examines how financial infrastructure and air connectivity relate to new business density across 28 transition economies over 2010–2024, and whether resource dependence moderates the relative contribution of branch-density and credit-volume channels (FDI and gross fixed capital formation serve as secondary benchmarks). Two-way fixed-effects panel regressions on an unbalanced panel of 28 transition economies (420 country-years as the maximal frame; the primary new-business-density model is identified on 249 complete cases from 24 economies), complemented by pooled OLS and between-effects estimators, are estimated for the three outcomes. Within countries, ATM penetration is the financial-infrastructure indicator most consistently associated with entrepreneurial activity ($\beta = 0.011$); trade openness is positive ($\beta = 0.006$) but does not survive relaxing the air-restricted sample. The relative contribution of bank branches versus domestic credit shifts with resource-rent intensity (branches × R = +0.016; credit × R = −0.011) – a pattern directionally stable across specifications but resting on the interaction design, a small complete-case panel, and a static moderator, its branch leg particularly sensitive to sample composition; the reversal is therefore read as suggestive rather than definitive. Air-passenger connectivity is a structural between-country correlate of entrepreneurship (between-effects $\beta = +0.310$) but not a within-country driver. New business density is more fully explained than the secondary outcomes (within-$R^2 = 0.26$ versus 0.14 and 0.09); conclusions are therefore drawn for firm entry rather than for the investment-and-entrepreneurial ecosystem.

Keywords financial infrastructure, transport connectivity, new business density, entrepreneurship, resource dependence, transition economies, public finance

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INTRODUCTION

Sustaining investment in productive capacity remains a central public-finance challenge for transition economies a third of a century after market reforms began. Global foreign direct investment rebounded by 14% in 2025 to an estimated USD 1.6 trillion, but over USD 140 billion came from volatile financial-center conduit flows, so underlying investment rose only about 5% (UNCTAD, 2026). International project finance – the principal vehicle for cross-border infrastructure – fell for a fourth consecutive year (–16% in value, –12% in deals) to its lowest level since 2019 (UNCTAD, 2026). The European Bank for Reconstruction and Development (EBRD) estimates regional growth

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at 3.4% in 2025 and 3.6% in 2026, but with a sharp east-west divergence: 6.9% in Central Asia in 2025 (5.6% projected for 2026) against 2.9% in Eastern Europe and the Caucasus (EBRD, 2026). Allocating public finance to financial and transport infrastructure thus acquires renewed salience.

Financial inclusion in Europe and Central Asia rose from 44% account ownership in 2011 to 78% in 2021 but has since stagnated, holding at 78% in 2024, suggesting the conventional financial-deepening agenda is nearing its margin of effectiveness in many post-socialist economies (World Bank, 2025a). Entrepreneurial activity remains highly uneven: Estonia leads the World Bank Entrepreneurship Database with over 24 new limited-liability registrations per 1,000 working-age adults, whereas new business density averages 4.2 in upper-middle-income economies (2021) and just 1.7 in lower-middle-income ones (2024) (World Bank, 2025b). SMEs generate over 99% of firms and over 60% of employment across the OECD, with a comparable role in the Eastern Partnership economies (OECD, 2024). Yet financial access is only one face of the infrastructure conditioning firm entry: physical and digital connectivity – here proxied by per-capita air-passenger traffic and fixed broadband – varies regionally by orders of magnitude. These patterns make new-firm formation, not aggregate capital, the first-order channel through which infrastructure shapes the investment-and-entrepreneurial ecosystem.

A central allocation question is whether infrastructure's contribution to entrepreneurship is uniform or whether resource dependence reshapes the effectiveness of branch- versus credit-based deepening. The sample's two most resource-dependent economies – Azerbaijan (resource rents 29.9% of GDP) and Kazakhstan (26.8%) in 2021 (World Bank, 2025c) – face a diversification challenge: aggregate credit may accommodate rather than dilute commodity exposure, while branch density may better reach non-extractive firms. Prior work has studied financial-development determinants of FDI and growth, but, to our knowledge, has devoted less attention to how resource dependence moderates these channels for entrepreneurship, or to whether transport connectivity acts structurally across countries rather than dynamically within them. These questions are taken up here for a panel of 28 transition economies over 2010–2024.

1. LITERATURE REVIEW

The proposition that access to finance underpins firm creation and small-business development is among the most firmly established in the development-finance literature; foundational quasi-experimental evidence that bank-branch expansion raises entrepreneurial and labor-market activity (Bruhn & Love, 2014) is echoed by recent cross-country findings for emerging and middle-income economies (Ananzeh et al., 2025; Berkane et al., 2025; Polishchuk et al., 2020). This baseline relationship is widely held to be conditional rather than automatic: financial inclusion combined with a supportive institutional environment spurs early-stage firm creation (Charfeddine & Zaouali, 2022; Marozva et al., 2026) – though this baseline relationship may hold only beyond a threshold level of financial-inclusion adoption (Logogye et al., 2025) – while institutional quality and adaptive firm governance are repeatedly identified as the catalysts that convert financial inputs into sustained growth and successful firm maturation (Bagirzade, 2025b; Elbroumi, 2025; Tu et al., 2024). A parallel strand shifts attention from external access to internal capability: entrepreneurial orientation and innovation capability shape whether financially included firms expand (Abu Taleb et al., 2025; Fahmi et al., 2025), as do sustainable-marketing practices and green entrepreneurial orientation (Maulid Adha et al., 2026; Musfar et al., 2025). The financial side of the same question extends beyond credit to insurance provision and to firm-level financial decision-making, where coverage gaps and the moderating role of financial technology shape firm value (Daskalakis & Milienos, 2025; Noor et al., 2024). Taken together, this body of work establishes that financial access matters for entrepreneurship but leaves open which specific component of financial infrastructure carries the effect.

A second strand of the literature treats infrastructure itself – digital, banking-system, and connectivity – as the transformative layer behind firm formation and macroeconomic performance. The

foundational evidence that broadband expansion raises growth (Czernich et al., 2011) has been extended to show that high-speed broadband amplifies entrepreneurial activity, while national digital and artificial-intelligence readiness increasingly shapes banking-sector profitability (Murshudli & Loguinov, 2019; Murshudli et al., 2020; Sitnicka et al., 2025; Zhao & Semachew, 2025). A recurring finding is that strategic orientation and targeted investment matter more than baseline national wealth, so that upper-middle-income economies can match higher-income peers in banking-ecosystem digitalization, even as denser "smart-city" ecosystems do not mechanically translate into stronger start-up activity (Abbasova et al., 2025; Kuzior et al., 2025). At the service-delivery level, omnichannel digital integration is treated as essential for competitiveness and human-development outcomes, while foundational connectivity tools remain decisive for overcoming isolation in constrained and rural settings (Bappayo & Kakudi, 2025; Conley, 2026; Malaquias et al., 2023; Tossekbayev et al., 2025), even as the unchecked spread of digital information can amplify local conflict (Bappayo et al., 2026; Bagirzade, 2025a). Yet relatively little of this literature appears to separate the retail-access dimension of financial infrastructure from the credit dimension, so their relative contributions to entrepreneurship remain, in our reading, only partly resolved.

A third strand examines aggregate capital flows rather than firm entry, and here the emphasis falls on absorptive capacity. Foreign direct investment is consistently presented as a catalyst for capital formation, growth, and sustainable development, with inward flows linked to longer-run economic expansion across Central and Eastern European and other recipient economies (Aleksandravičienė et al., 2024; Bieleń et al., 2024; Mursalov et al., 2025). The relationship between inward investment and domestic industrial outcomes is frequently strong in correlation yet weak in short-run causality, suggesting that aggregate investment responds to structural alignment rather than to infrastructure shocks alone (Baghirzade et al., 2025). Resource endowments complicate this picture: the classic resource-curse evidence shows that economies rich in natural resources tend to grow more slowly than resource-poor ones (Sachs & Warner, 2001), and where extraction dominates, investment can carry severe socio-environmental costs that formal governance struggles to contain (Musnadi et al., 2024). This distinction between aggregate capital flows and firm-level entrepreneurship is consequential because public infrastructure may influence the two channels very differently.

Because infrastructure provision is ultimately a public-finance decision, a fourth literature situates these mechanisms within governance and public investment. Strategic public-private partnerships and adaptive public-finance management are presented as central to modernizing public services and revitalizing regional economies (Oe et al., 2025; Topazly et al., 2025) and to managing demographic change and inclusive labor-market integration (Zahorodnia et al., 2026a, 2026b). Government expenditure is shown to be highly sensitive to macroeconomic fundamentals and to shape exchange-rate stability and economic security, though excessive reliance on state financing risks crowding out private capital (Ahmed, 2025; Filipova et al., 2025; Tsymbal & Demediuk, 2025). A complementary set of studies treats the modernization of public-service infrastructure itself as a precondition for effective delivery: digital tools and artificial intelligence are applied to public-service domains from waste management to emergency response (Kajda & Karwot, 2025, 2026; Mercer-Bey, 2025), investment in human capital and lifelong learning is tied to preserving institutional capacity (Davlikanova, 2025; Yeremenko, 2026), and technological development is linked to reducing corruption (Sadigov et al., 2025; Yefimenko et al., 2025). Across these accounts, however, public-finance allocation to infrastructure is rarely connected to firm-level entrepreneurial outcomes in economies undergoing transition.

Three gaps follow from this review. First, the infrastructure–entrepreneurship link is predominantly estimated on broad cross-country panels that pool developing, emerging, and global samples, so the within-country effect specific to transition economies remains largely untested. Second, while the moderating role of resource abundance on institutional quality and growth has been studied for post-Soviet states, to our knowledge, relatively few studies have isolated

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how resource dependence reshapes the relative effectiveness of branch-based versus credit-based financial deepening. Third, the temporal evolution of these relationships under resource dependence is still underexplored. To address these gaps, the present study employs a two-way fixed-effects panel of 28 transition economies over 2010–2024 that identifies associations from within-country variation and treats new business density as the primary outcome, with foreign direct investment and gross fixed capital formation as secondary benchmarks, foregrounding firm creation rather than aggregate capital.

The aim of the study is to determine whether financial infrastructure is uniformly associated with new business density across these economies or whether this association is conditioned, and potentially reversed, by resource dependence, and to assess whether transport connectivity operates structurally across countries rather than dynamically within them. In doing so, the study seeks to establish how scarce public finance should be allocated across resource-rich and resource-scarce transition economies.

2. METHODOLOGY

2.1. Data and sample

The analysis uses an unbalanced panel of 28 transition economies over 2010–2024 (T = 15; 420 country-years as the maximal frame), classified by the World Bank Group across five regional groups (Appendix A). These 28 are the post-socialist transition economies tracked jointly by the EBRD and the World Bank for the region, retained where World Development Indicators coverage over 2010–2024 sufficed to construct the regressor set. Because the indicators differ in coverage, the estimation samples are complete-case: the new-business-density model is identified on 249 country-years from 24 economies, the binding constraint being the air-freight series (the sparsest, at 290 observations), which is entirely absent for Albania, North Macedonia, Slovakia, and Kosovo (Kosovo additionally lacks broadband and regulatory-quality data); Appendix F reports the country-years each economy contributes. This attrition is overwhelmingly an air-traffic-coverage artefact rather than systematic selection: full- versus complete-case means shift only marginally (Appendix F), and the probability of entering the estimation sample is unrelated to resource-rent intensity – the study's moderator (Pearson $r \approx 0$, $p = 0.99$; cluster-robust logit $p = 0.92$) – and is only mechanically related to geography (the inclusion rate is lower in South-Eastern Europe, $\chi^2(4) = 14.6$, $p = 0.006$, where three of the four air-freight gaps fall; the income-group difference, $\chi^2(2) = 8.3$, $p = 0.015$, is non-monotonic). Section 3.6 confirms that the central results hold when the air-transport variables are dropped and the excluded economies re-enter. All series come from World Bank Group sources – the World Development Indicators (World Bank, 2025c), carrying the Financial Access Survey data on ATM and bank-branch density; the Worldwide Governance Indicators (World Bank, 2025d); and the Entrepreneurship Database (World Bank, 2025b) – giving consistent definitions and a single auditable origin. Air-traffic series originate from ICAO via the WDI, with zero-value reports treated as missing.

The dependent variables are the natural logarithm of new business density (ln(NBD), the primary outcome; newly registered limited-liability companies per 1,000 working-age adults), FDI net inflows (% of GDP), and gross fixed capital formation (% of GDP). Hungary, a financial-account-passthrough outlier, is excluded from the FDI regressions (Appendix C).

2.2. Variables and operationalization

Regressors fall into four groups: financial infrastructure (ATMs and commercial bank branches per 100,000 adults; domestic credit to the private sector, % of GDP); connectivity and transport infrastructure (fixed broadband per 100 people; the logs of air passengers and air freight per working-age adult); macroeconomic controls (trade openness, CPI inflation, log GDP per capita); and the Worldwide Governance Indicators Regulatory Quality estimate as institutional control. Air-traffic series are normalized by working-age population and log-transformed to remove the country-size confound and compress their heavy right tail. Table 1 reports full definitions, units, and sources.

Table 1. Variable definitions, operational measurement, and sources

Variable	Operational definition	Source	Role
ln(NBD)	Natural logarithm of new business density (newly registered limited-liability companies per 1,000 working-age adults)	WBG WDI; Doing Business / Entrepreneurship Database	Dep. var. (primary)
FDI inflows	Foreign direct investment, net inflows (% of GDP)	WBG WDI	Dep. var. (secondary)
GFCF	Gross fixed capital formation (% of GDP)	WBG WDI	Dep. var. (secondary)
ATMs / 100k	Automated teller machines per 100,000 adults	WBG WDI (FAS)	Financial infra
Branches / 100k	Commercial bank branches per 100,000 adults	WBG WDI (FAS)	Financial infra
Credit / GDP	Domestic credit to the private sector by banks (% of GDP)	WBG WDI	Financial infra
Broadband / 100	Fixed broadband subscriptions per 100 inhabitants	WBG WDI; ITU	Connectivity
ln(air pass / WA)	Natural log of air passengers carried per working-age adult (15-64). Zero-passenger reports are treated as missing	WBG WDI (ICAO)	Transport infra
ln(air freight / WA)	Natural log of air freight (million ton-km) per working-age adult	WBG WDI (ICAO)	Transport infra
Trade openness	Trade (sum of exports and imports) as % of GDP.	WBG WDI	Macro control
Inflation	Inflation, consumer prices (% annual)	WBG WDI; IMF IFS	Macro control
RQ	Worldwide Governance Indicators – Regulatory Quality estimate	WBG WGI	Institutional control
ln(GDP pc)	Natural log of GDP per capita (constant 2015 USD).	WBG WDI	Macro control
Natres rents	Total natural resource rents (% of GDP)	WBG WDI	Resource-dep. ingredient
Resource dep. (R)	Country-level average of natres rents 2010–2018; centered logarithm enters as moderator	Constructed.	Moderator

Note: WBG WDI = World Bank World Development Indicators; WBG FAS = Financial Access Survey (Global Financial Inclusion Database); WBG WGI = Worldwide Governance Indicators; ICAO = International Civil Aviation Organization; ITU = International Telecommunication Union; IMF IFS = International Financial Statistics. WA = working-age population (15-64). All air-traffic series are corrected for zero-value reporting gaps (treated as missing, not as true zeros).

2.3. The moderator: resource dependence

Resource-rent intensity varies widely across the sample – from 0.24% of GDP (Moldova) to 23.82% (Azerbaijan) – which, together with the resource-curse and resource-blessing literatures, motivates treating resource dependence as a moderator of the infrastructure coefficients. The static moderator R_i is the country-level average of total natural resource rents (% of GDP) over 2010–2018, a window pre-dating the post-COVID energy-price distortion. The centered moderator entering the regressions is

$$\tilde{R}_i = \ln\left(1+R_i\right) - mean_i\left[\ln\left(1+R_i\right)\right], \qquad (1)$$

where $mean_i$ is the cross-country average; centering tames the right skew of raw rents and interprets the level-term coefficient at the sample-mean resource intensity (placing Moldova and Azerbaijan at −0.91 and +2.09). As a robustness check, $\tilde{R}_i$ is replaced by its dynamic, contemporaneous counterpart over 2010–2021 (Table 3, column 4).

2.4. Empirical specification

The baseline two-way fixed-effects specification for new business density is

$$\ln\left(NBD_{it}\right) = \alpha_i + \lambda_t + \beta' F_{it} + \gamma' C_{it} + \varepsilon_{it}, \qquad (2)$$

where subscripts *i* and t index country and year, and the dependent variable is the log of new business density; α_i and λ_t are country and year fixed effects; F_{it} is the 6×1 vector of infrastructure regressors (ATMs, branches, credit, broadband, ln(air pass/WA), ln(air freight/WA)) with coefficient vector β; C_{it} is the 3×1 control vector (trade openness, inflation, Regulatory Quality) with coefficient vector γ; the prime (′) denotes the transpose; and ε_{it} is the idiosyncratic error term. The fixed effects absorb all time-invariant country attributes and common annual shocks, leaving purely within-country identification.

The moderation specification adds interactions of each infrastructure regressor with the moderator:

$$\ln\left(NBD_{it}\right) = \alpha_i + \lambda_t + \beta' F_{it} + \delta'\left(F_{it}\cdot\tilde{R}_i\right) + \gamma' C_{it} + \varepsilon_{it}, \qquad (3)$$

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where δ is the coefficient vector on the interaction terms, – each infrastructure regressor multiplied by the moderator. The full form (D1) uses all six interactions; the parsimonious form (D3) keeps the two surviving D1's 5% pretest (branches × R, credit × R).

Because $\tilde{R}_i$ is time-invariant, α_i absorbs its main effect, so it enters only through the interactions – the design asks whether the within-country effect of branches or credit varies with resource intensity, not whether resource-dependent economies differ on average. Pooled OLS and between-effects estimates accompany FE for triangulation. Because identification rests on an observational macro-panel, all estimates are interpreted as within-country associations rather than causal effects. The two-way fixed effects absorb time-invariant country attributes and common annual shocks, but cannot rule out reverse causality – higher entrepreneurial activity may itself encourage ATM deployment, financial-service expansion, and improved air connectivity – or time-varying omitted variables such as business regulation, tax policy, EU-accession dynamics, venture financing, digital-government development, educational attainment, migration patterns, and structural reforms. The results below are read with these limits in mind.

2.5. Inference and robustness strategy

Standard errors are cluster-robust at the country level (CRV1) for the pooled OLS and FE columns, and heteroskedasticity-robust for the between-effects column (estimated on 23-24 country means). For the marginal effects in Section 3.3 and Appendix E, the moderator is recentered at each reference country's value, and the model is refitted. Hence, the level-term coefficient gives the conditional marginal effect at that country's resource intensity.

Three robustness checks probe the moderation: dropping Azerbaijan; dropping Azerbaijan and Kazakhstan; and the dynamic moderator over 2010–2021 (Table 5, columns 2-4). The FE-over-RE choice rests on a Mundlak (robust-Hausman) test on country-mean-augmented regressors, with joint significance from a Wald statistic distributed χ^2 under the null.

3. RESULTS

3.1. Descriptive statistics

Table 2 reports descriptive statistics for the 28-country panel. New business density averages 4.75 firms per 1,000 working-age adults across 405 country-year observations, with substantial right-skew (median 3.30, maximum 29.41 in Estonia). Among financial-infrastructure indicators, ATMs per 100,000 adults range from 4.57 to 184.87 (mean 63.99, SD 29.93), bank branches per 100,000 adults range from 0.38 to 92.16 (mean 23.76), and domestic credit to the private sector spans 9.33% to 96.64% of GDP (mean 43.23%). Air-passenger traffic exhibits the highest skew in raw form (mean 6.09 million passengers, maximum 108.86 million); after normalization by working-age population and log transformation, the dispersion compresses to a tractable range (mean –1.31, SD 1.34, span –5.84 to +2.19). Air freight per working-age adult is similarly heavy-tailed, with the log-transformed series ranging from –24.04 to –7.71 across 290 valid observations. The cross-country diversity is largest in resource dependence, where the static average ranges from 0.24% of GDP (Moldova) to 23.82% (Azerbaijan).

3.2. Main results: correlates of new business density

Table 3 reports the three core estimators – pooled OLS, between-effects, and two-way country-and-year fixed effects – for the log of new business density on the full set of financial and transport infrastructure indicators with macroeconomic controls. Cluster-robust standard errors are reported at the country level for pooled OLS and FE; the between-effects column is estimated on country-level means (N = 24, four countries dropped owing to missing means in air-freight or related controls).

In the pooled cross-section, four indicators contribute robustly to entrepreneurial activity: ATMs per 100,000 adults (β = 0.010, p = 0.017), bank branches per 100,000 adults (β = 0.011, p = 0.005), fixed broadband (β = 0.028, p = 0.010), and air passengers per working-age adult (β = 0.163, p = 0.068, marginally significant). Domestic credit and air freight per working-age adult are not significant. Regulatory Quality enters strongly positive (β =

Table 2. Descriptive statistics, 28 transition economies, 2010–2024

Variable	N	Mean	SD	Min	Median	Max
FDI net inflows (% GDP)	420	4.24	7.80	–40.11	3.38	105.64
Gross fixed capital formation (% GDP)	419	23.21	4.53	11.87	22.45	40.07
New business density (per 1k working_age)	405	4.75	4.89	0.06	3.30	29.41
ATMs per 100,000 adults	385	63.99	29.93	4.57	59.53	184.87
Commercial bank branches per 100,000	383	23.76	14.57	0.38	23.78	92.16
Domestic credit to private sector (% GDP)	395	43.23	15.89	9.33	43.70	96.64
Air passengers carried (millions)	332	6.09	16.43	0.011	1.28	108.86
Air freight (million ton_km)	290	286.08	1,078.01	0.00009	2.78	6845.23
ln(air passengers / WA adult)	332	–1.31	1.34	–5.84	–1.33	2.19
ln(air freight ton_km / WA adult)	290	–13.99	2.37	–24.04	–14.20	–7.71
Fixed broadband per 100	402	20.64	9.58	0.06	21.70	39.72
GDP per capita (const 2015 USD)	420	8,922	6,038	771	6,632	26,135
Trade (% GDP)	419	106.39	35.58	29.19	100.62	204.06
Natural resource rents (% GDP, dyn.)	336	3.75	6.15	0.13	1.22	32.88
Inflation, CPI (% YoY)	411	5.18	6.28	–1.58	3.34	59.22
Regulatory Quality (WGI)	378	0.23	0.73	–1.73	0.27	1.69
Resource dependence (static avg)	420	3.76	5.77	0.24	1.33	23.82

Note: All variables are constructed from World Bank Group sources (World Development Indicators, Global Financial Inclusion Database, Worldwide Governance Indicators). Working-age population (WA) denotes the population aged 15-64. Air-traffic series are reported by ICAO via the WDI; observations with reported values of zero are treated as missing (likely reporting gaps for Kosovo and selected Macedonian years). The static resource-dependence variable is the country-level mean of total natural resource rents over 2010–2018. The country list is given in Appendix A.

0.592, p = 0.018), consistent with its role as the dominant institutional control.

The between-effects column – a pure cross-country comparison of long-run means – surfaces the structural relationship that is most relevant for the public-finance audience concerned with allocation: air passengers per working-age adult is the strongest single predictor of long-run entrepreneurial density (β = +0.310, p = 0.014), exceeding even the BE coefficient on bank branches (β = 0.016, p = 0.087). Regulatory Quality remains highly elastic (β = 0.954, p = 0.017). This pattern indicates that, across transition economies, those with greater air connectivity per capita exhibit structurally higher rates of new firm formation, even after netting out time-invariant unobservables – a finding consistent with the broader literature on connectivity, knowledge spillovers, and entrepreneurial ecosystems.

The two-way fixed-effects column isolates within-country dynamic variation and is the most stringent specification. Only two regressors survive: ATMs per 100,000 adults (β = 0.011, p = 0.004) and trade openness (β = 0.006, p = 0.038). Bank branches, credit, broadband, and both air-connectivity measures lose significance once country-and-year fixed effects are absorbed. This BE–FE divergence is the central methodological message of the paper: long-run cross-country differences in branches and air connectivity are confounded with persistent country attributes (regulatory environment, market depth, education, geography); the only within-country shock that consistently shifts entrepreneurial activity over our 15-year window is retail financial access, captured by the ATM channel. R^2 increases from 0.717 (pooled) to 0.947 (FE), with within-R^2 of 0.260.

3.3. The role of resource dependence: moderation analysis

To test whether the contribution of financial-deepening channels depends on the resource-rent intensity of the economy, we extend the FE specification with interactions between the four financial indicators (ATMs, branches, credit, broadband), the two air-connectivity indicators (passengers and freight per working-age adult), and the centered logarithm of long-run resource rents. Table 4 reports three columns: the Baseline FE (no interactions) for reference, Specification D1 (full moderation with all six interactions), and Specification D3 (parsimonious, retaining only branches × R and credit × R, which were the two interactions surviving D1's pretest at the 5% level).

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Table 3. New business density regressions – pooled OLS, between effects, fixed effects

Variable	Pooled OLS	Between Effects	Fixed Effects
ATMs per 100k adults	0.010**	0.005	0.011***
	(0.004)	(0.007)	(0.003)
Bank branches per 100k adults	0.011***	0.016*	0.002
	(0.004)	(0.009)	(0.006)
Domestic credit (% GDP)	–0.003	0.010	0.002
	(0.005)	(0.017)	(0.004)
Fixed broadband per 100	0.028**	0.021	–0.002
	(0.010)	(0.019)	(0.016)
ln(air passengers / WA)	0.163*	0.310**	0.049
	(0.085)	(0.110)	(0.036)
ln(air freight ton-km / WA)	–0.060	–0.099	–0.041
	(0.047)	(0.079)	(0.025)
Trade (% GDP)	–0.002	–0.008	0.006**
	(0.004)	(0.005)	(0.003)
Inflation, CPI (% YoY)	0.007	0.079	–0.002
	(0.006)	(0.061)	(0.003)
Regulatory Quality (WGI)	0.592**	0.954**	–0.087
	(0.232)	(0.353)	(0.226)
N	249	24	249
R^2	0.717	0.822	0.947
R^2 Within	–	–	0.260

Note: Dependent variable: ln(new business density). Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10. Cluster-robust SE at the country level (CRV1) for pooled OLS and FE; heteroskedasticity-robust SE for between-effects (estimated on country averages over 2010–2024). FE includes country and year fixed effects (absorbed).

In the D1 column, the central conditional pattern emerges: branches × resource dependence enters strongly positive (β = +0.018, p < 0.001), while credit × resource dependence enters negative (β = –0.016, p = 0.003). The substantive interpretation – visualized in Figure 1 below – is that the relative effectiveness of branch density versus aggregate credit reverses with the resource-rent intensity of the economy. In resource-rich settings, branch-based retail access is more effective at supporting entrepreneurship than aggregate credit volume; in resource-scarce settings, the pattern flips.

D1 also surfaces a previously unexamined finding: ln(air passengers/WA) × resource dependence is negative and significant (β = –0.072, p = 0.047). The marginal contribution of air-passenger connectivity to entrepreneurship is therefore smaller – indeed, slightly negative – in highly resource-dependent economies. The remaining interactions (ATMs, broadband, and air-freight with resource dependence) are not statistically significant at conventional levels, though broadband × R is positive and borderline (β = +0.016, p = 0.119). Specification D3 retains only the two strongest interactions (branches × R, credit × R), confirming their magnitudes and stability: branches × R = +0.016 (p = 0.001) and credit × R = –0.011 (p = 0.031). Within-R^2 increases from 0.260 (Baseline) to 0.378 (D1) and 0.344 (D3). The sensitivity of this conditional pattern to sample composition and to the exclusion of the air-transport variables is assessed in Sections 3.5 and 3.6.

Figure 1 plots the implied marginal effects of branch density and credit volume on entrepreneurship across the full empirical range of the resource-dependence moderator, with 90% confidence bands. The two panels reveal a bidirectional pattern. In panel (a), the marginal effect of bank branches transitions from significantly negative at the resource-scarce end (Moldova: –0.011, p = 0.015) through zero around Bulgaria, to significantly positive at the Caspian end (Azerbaijan: +0.038, p = 0.002; Kazakhstan: +0.033, p = 0.002). In panel (b), the marginal effect of credit displays the opposite pattern: significantly positive at the resource-scarce end (Moldova: +0.012, p = 0.014; Czech Republic: +0.009, p = 0.026), declining through zero around Poland, and becoming negative but only marginally significant at the resource-rich end (Azerbaijan: –0.021, p = 0.103;

Table 4. New business density with resource-dependence moderation (FE, country-and-year)

Variable	Baseline FE	D1 full moderation	D3 parsimonious
ATMs per 100k adults	0.011***	0.007	0.010**
	(0.003)	(0.004)	(0.004)
Bank branches per 100k adults	0.002	0.002	0.004
	(0.006)	(0.004)	(0.004)
Domestic credit (% GDP)	0.002	0.002	0.002
	(0.004)	(0.004)	(0.004)
Fixed broadband per 100	−0.002	0.004	−0.001
	(0.016)	(0.014)	(0.014)
ln(air passengers / WA)	0.049	0.011	0.047
	(0.036)	(0.033)	(0.030)
ln(air freight ton-km / WA)	−0.041	−0.044*	−0.040
	(0.025)	(0.023)	(0.026)
ATMs × resource dependence		0.001	
		(0.003)	
Branches × resource dependence		0.018***	0.016***
		(0.004)	(0.004)
Credit × resource dependence		−0.016***	−0.011**
		(0.005)	(0.005)
Broadband × resource dependence		0.016	
		(0.010)	
ln(air pass/WA) × resource dependence		−0.072**	
		(0.034)	
ln(air freight/WA) × resource dependence		0.013	
		(0.018)	
Trade (% GDP)	0.006**	0.007**	0.007**
	(0.003)	(0.003)	(0.003)
Inflation, CPI (% YoY)	−0.002	−0.002	−0.002
	(0.003)	(0.002)	(0.003)
Regulatory Quality (WGI)	−0.087	−0.425*	−0.284
	(0.226)	(0.219)	(0.236)
N	249	249	249
R^2 Within	0.260	0.378	0.344

Note: Dependent variable: ln(new business density). Country-and-year fixed effects absorbed. Standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10. Cluster-robust SE at the country level (CRV1). D1 = full moderation with all six financial-and-transport interactions; D3 = parsimonious moderation retaining only branches × R and credit × R.

Kazakhstan: −0.018, p = 0.119). The point estimates for each of the six reference countries are reported in Appendix E.

3.4. Foreign direct investment and gross fixed capital formation

Consistent with the study's design, FDI net inflows and gross fixed capital formation are treated as secondary benchmark outcomes: their associations with the infrastructure block are weaker and less robust than for new business density, and their full results are therefore reported in Appendices C and D. For FDI net inflows (% GDP), excluding Hungary as an established financial-account-passthrough outlier, three regressors achieve significance in the FE column: domestic credit (β = −0.035, p = 0.042), fixed broadband (β = +0.204, p = 0.085, marginal), and trade openness (β = +0.066, p = 0.025). Neither air-connectivity measure is significant in the FE column. Within-R^2 reaches 0.142 (compared to 0.260 for NBD), indicating that the model captures meaningfully less of within-country FDI variation than within-country entrepreneurial activity.

For gross fixed capital formation (% GDP), the FE column yields no statistically significant coefficient (within-R^2 = 0.089), confirming that within-country fluctuations in GFCF respond primarily to factors outside the infrastructure-and-controls

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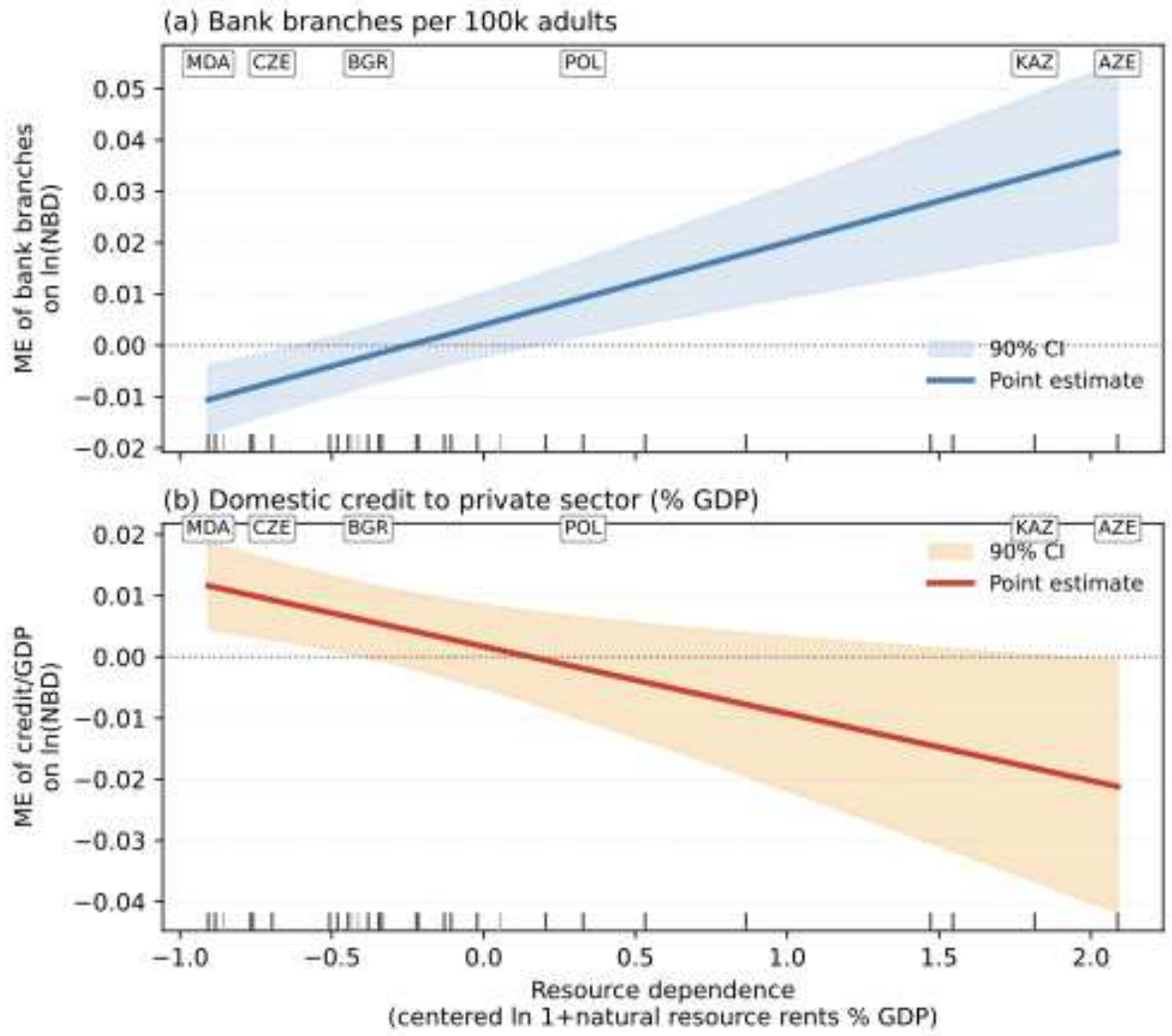

Note: Shaded bands are 90% cluster-robust confidence intervals. Vertical ticks mark the resource-dependence positions of all 28 panel economies, overlapping where values nearly coincide; lighter ticks denote the four economies outside the complete-case estimation sample, and boxed labels mark six reference economies spanning the distribution.

Figure 1. Marginal effects of bank branches per 100,000 adults (panel a) and domestic credit (% GDP) (panel b) on ln(new business density), across the empirical range of centered ln(1 + resource rents % GDP)

vector. However, the pooled and between-effects columns reveal a striking cross-section pattern: air passengers per WA enter positive and significant (Pooled: $\beta = +1.325$, $p = 0.017$; Between: $\beta = +1.167$, $p = 0.026$), while air freight per WA enters negative and significant in the pooled column ($\beta = -0.534$, $p = 0.006$) and marginally in the between-effects column ($\beta = -0.572$, $p = 0.090$). The contrasting signs on the two air-connectivity dimensions suggest that long-run capital formation is positively associated with passenger-side connectivity (business mobility, tourism, services) and negatively with freight intensity – a composition effect warranting separate investigation.

3.5. Robustness

Table 5 reports four robustness checks of the D3 moderation specification. Columns 2 and 3 sequentially drop the most resource-dependent economies (Azerbaijan, then Azerbaijan plus Kazakhstan) to assess whether the moderation reversal is a Caspian phenomenon. Column 4 substitutes the dynamic ln(1 + natural resource rents) for the static moderator over the 2010–2021 window.

In the no-AZE sub-sample (N = 241), branches × R remains highly significant ($\beta = +0.017$, $p < 0.001$) and credit × R remains negative (β

= −0.010, p = 0.066). In the more aggressive no-AZE-and-no-KAZ sub-sample (N = 233), branches × R strengthens (β = +0.020, p < 0.001) while credit × R loses statistical significance (β = −0.010, p = 0.103); air freight per WA, however, becomes negative and significant (β = −0.057, p = 0.049). The dynamic-moderator specification (column 4, N = 219) preserves the qualitative pattern at smaller magnitude: branches × ln1p(natres) = +0.007 (p = 0.045) and credit × ln1p(natres) = −0.006 (p = 0.043), confirming that the bidirectional reversal is not an artefact of the static moderator construction. Across all robustness sub-samples, ATMs retain a significant within-country effect on entrepreneurship (β ≈ 0.010, p < 0.05), and trade openness remains positive throughout (β ≈ 0.005-0.008).

3.6. Diagnostics and limitations

Two specification tests support the FE choice and the moderation structure. First, a Mundlak (robust-Hausman) test comparing FE against random-effects yields $\chi^2(9) = 27.43$, p = 0.001, decisively rejecting random-effects consistency in favor of fixed effects – the natural choice given country-specific institutional persistence in transition economies. Second, multicollinearity is acceptable: pairwise correlations among regressors stay below |r| = 0.55 except for the constructed natural-resource-rents pair (dynamic vs static: r = +0.94, by construction) and air passengers versus air freight in absolute counts (r = +0.86, by construction); the full correlation matrix is reported in Appendix B.

Table 5. Robustness checks of the D3 moderation specification

Variable	D3 full	Drop AZE	Drop AZE + KAZ	Dyn. moderator 2010–2021
ATMs per 100k adults	0.010**	0.010**	0.010**	0.010**
	(0.004)	(0.004)	(0.004)	(0.004)
Bank branches per 100k adults	0.004	0.004	0.005	0.004
	(0.004)	(0.004)	(0.004)	(0.006)
Domestic credit (% GDP)	0.002	0.002	0.002	0.001
	(0.004)	(0.004)	(0.005)	(0.003)
Fixed broadband per 100	−0.001	0.001	0.001	0.008
	(0.014)	(0.014)	(0.015)	(0.013)
ln(air passengers / WA)	0.047	0.054*	0.058*	0.038
	(0.030)	(0.026)	(0.028)	(0.028)
ln(air freight ton-km / WA)	−0.040	−0.053*	−0.057**	−0.042
	(0.026)	(0.028)	(0.027)	(0.029)
Branches × resource dependence	0.016***	0.017***	0.020***	
	(0.004)	(0.004)	(0.003)	
Credit × resource dependence	−0.011**	−0.010*	−0.010	
	(0.005)	(0.005)	(0.006)	
Branches × ln1p(natres) [dynamic]				0.007**
				(0.003)
Credit × ln1p(natres) [dynamic]				−0.006**
				(0.003)
Trade (% GDP)	0.007**	0.008**	0.008***	0.005
	(0.003)	(0.003)	(0.003)	(0.003)
Inflation, CPI (% YoY)	−0.002	−0.002	−0.003	−0.002
	(0.003)	(0.003)	(0.003)	(0.002)
Regulatory Quality (WGI)	−0.284	−0.380	−0.452*	−0.068
	(0.236)	(0.227)	(0.220)	(0.253)
N	249	241	233	219
R^2 Within	0.344	0.362	0.365	0.283

Note: Dependent variable: ln(new business density). Country-and-year fixed effects absorbed. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10. Cluster-robust SE at the country level. Column (1) repeats the D3 specification on the full 28-country sample; columns (2)-(3) drop Azerbaijan (and additionally Kazakhstan); column (4) uses the dynamic moderator ln(1 + natural resource rents % GDP), centered at the within-sample mean, on the 2010–2021 window.

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The principal limitation introduced by adding normalized air-connectivity variables is the reduction in effective sample size from 336 to 249 country-year observations in the moderation specifications, reflecting missingness in the World Bank's air-traffic series (Kosovo, selected Macedonian years). This loss is accepted as the necessary cost of honestly testing transport infrastructure: the alternative – leaving air connectivity descriptive only – would have left the transport dimension of the study empirically empty. With the smaller effective sample, the within-R^2 of the Baseline FE specification rises from 0.190 without the air controls to 0.260 with them, and the D3 moderation specification reaches 0.344, indicating that the normalized air-connectivity controls contribute substantively to model fit even when their own coefficients are not significant in the within-country FE column. The Conclusion discusses the implications of these patterns for public-finance allocation.

A final check addresses the concern that the air-transport variables, by restricting the sample, might drive the findings. Column A of Table 6 is the baseline specification (D3, with air, 249 observations); columns B and C re-estimate it without the two air-connectivity regressors. On the identical 249-observation sample (column B), every coefficient is essentially unchanged, so the air controls do not generate the results. On the full 336-country-year sample that the air series had restricted – 27 economies, re-including Albania, North Macedonia, and Slovakia (column C) – the within-country ATM association (0.010, p = 0.024) and the credit × resource-dependence interaction (–0.010, p = 0.042) remain significant, whereas trade openness loses significance (p = 0.42) and the branch × resource-dependence interaction attenuates to marginal significance (0.010, p = 0.058). The composition pattern thus rests most firmly on the credit channel and the ATM result, while the branch leg is the more sample-sensitive of the two.

4. DISCUSSION

The results on new firm formation refine the development-finance literature while sharpening the within-cross-country divide. In the fixed-effects model, ATM penetration is the only financial-infrastructure indicator with a robust within-country effect on new business density; bank branches, aggregate credit, and broadband lose significance once country-and-year fixed effects are absorbed. This accords with evidence that financial inclusion raises early-stage entrepreneurship (Pham et al., 2025) but locates the effect in retail transaction access rather than aggregate credit. It stands against findings that ATM density carries no effect on inclusive outcomes across the European Union (Laskienė et al., 2026) – a divergence plausibly traced to our within-country identification and firm-formation focus. In the between-effects estimates, air-passenger connectivity is instead the strongest cross-country predictor of long-run entrepreneurial density, extending the connectivity–entrepreneurship nexus to physical mobility as a structural, not cyclical, relationship. Taken to-

Table 6. Robustness of the moderation to excluding the air-transport variables

Coefficient	A: with air (N = 249)	B: no air, same N = 249	C: no air, full N = 336
ATMs	0.010**	0.010**	0.010**
	(0.004)	(0.004)	(0.004)
Trade openness	0.007**	0.006**	0.002
	(0.003)	(0.003)	(0.003)
Branches × R	0.016***	0.017***	0.010*
	(0.004)	(0.004)	(0.005)
Credit × R	–0.011**	–0.011**	–0.010**
	(0.005)	(0.005)	(0.005)
within-R^2	0.344	0.324	0.239
N (country-years)	249	249	336
Economies	24	24	27

Note: Dependent variable: ln(new business density); Specification D3 (FE with country and year fixed effects). Standard errors in parentheses, cluster-robust at the country level (CRV1). *** p < 0.01, ** p < 0.05, * p < 0.10. Column A reproduces Table 5 (D3); column B drops the two air-connectivity regressors on the same 249-observation sample; column C re-estimates without air on the full 336-observation sample.

gether, the two estimators assign transport infrastructure a specific role: it operates as a structural, between-country correlate of entrepreneurial density rather than as a dynamic within-country driver – economies with denser air networks sustain systematically higher rates of firm entry, but within-country changes in connectivity over the 15-year window are not accompanied by detectable changes in new business density.

For aggregate capital flows (the secondary benchmark outcomes), the infrastructure channels are weaker than for firm entry. In the FDI specification (excluding Hungary as a passthrough outlier), trade openness and domestic credit are the robust within-country correlates, and neither air-connectivity measure is significant. The positive trade coefficient qualifies the classic account in which market size, proximity, and labor costs, rather than openness, drive FDI into transition economies (Bevan & Estrin, 2004), suggesting the salient margin has shifted across the two decades separating the samples. The negative credit coefficient is complementary to evidence that domestic financial development conditions the translation of inflows into growth (Dua & Verma, 2024). Gross fixed capital formation is the least predictable outcome within countries, yet its cross-section shows a composition effect – passenger connectivity positive, freight negative – reinforcing that the infrastructure–investment linkage runs through firm creation.

The third result engages the resource-curse literature directly: the relative effectiveness of branch- and credit-based deepening shifts with resource-rent intensity. In resource-scarce economies, branch density becomes negative and credit positive; in the resource-rich Caspian economies, the signs flip. The same gradient attenuates the entrepreneurial premium on air-passenger connectivity. Because the branch reversal survives dropping Azerbaijan and Kazakhstan and a dynamic moderator, it spans the dependence spectrum rather than being a Caspian artefact. This is consistent with evidence that energy abundance negatively moderates otherwise-positive developmental channels in post-Soviet states (Gasimov et al., 2023), and it qualifies findings that regulatory quality bears a positive relationship with non-oil growth in Azerbaijan (Seyfullayev & Cak, 2025), implying that resource wealth distorts the composition of financial deepening rather than nullifying institutional channels. Our results are consistent with reframing the resource curse as a question of financial-deepening composition. The evidential weight of this reading must, however, match its base: the pattern is identified from an interaction specification estimated on a complete-case panel of 24 economies with a static, pre-determined moderator, and while the credit leg and the ATM association survive restoring the full 336-observation sample, the branches × resource-dependence interaction attenuates to marginal significance once the air-transport variables are excluded (Section 3.6). Because the models identify conditional correlations rather than the underlying mechanism, this is offered as a suggestive interpretive direction rather than a demonstrated causal claim.

CONCLUSION

This paper aims to examine how financial infrastructure and air connectivity relate to new business density in 28 transition economies over 2010–2024, using an unbalanced country-year panel with pooled OLS, between-effects, and two-way fixed-effects estimators, with FDI net inflows and gross fixed capital formation as secondary benchmark outcomes, and a single moderator: long-run resource-rent intensity. Four findings emerge. First, ATMs per 100,000 adults are the financial-infrastructure indicator most consistently associated with entrepreneurial activity within countries ($\beta = 0.011$, $p = 0.004$); trade openness is also positive in the main specification ($\beta = 0.006$, $p = 0.038$) but is not robust once the air-restricted sample is relaxed; branches, credit, broadband, and air connectivity lose significance once country-and-year fixed effects are absorbed. Second, the relative effectiveness of branches versus credit shifts with resource-rent intensity: branches are positive in the resource-rich Caspian economies (Azerbaijan: +0.038; Kazakhstan: +0.033, both $p = 0.002$) and negative in resource-scarce ones (Moldova: −0.011, $p = 0.015$), while credit shows the mirror pattern. The credit leg and the within-country ATM association

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are robust to excluding the air-transport variables on the larger 336-observation sample; the branch leg, although robust to dropping the Caspian economies and to a dynamic moderator, is the more sample-sensitive of the two. This second finding is therefore stated as suggestive rather than definitive. Third, air-passenger connectivity is a strong structural cross-country predictor of entrepreneurial density (between-effects $\beta = +0.310$, $p = 0.014$) but does not enter the within-country column, and its interaction with resource dependence is negative ($\beta = -0.072$, $p = 0.047$) – its premium fades in highly resource-dependent economies. Transport infrastructure thus functions as a structural between-country correlate of firm entry rather than a dynamic within-country driver. Fourth, within-country predictability is ordered as new business density > FDI > gross fixed capital formation (within-$R^2 = 0.260, 0.142, 0.089$); FDI is associated within countries with trade openness, credit, and broadband.

For public-finance allocation, three implications follow. Retail-payment infrastructure (ATM-type point-of-presence networks) is the most consistent within-country correlate of new firm formation. The choice between branch expansion and credit-deepening appears conditional on resource-rent intensity – branches in resource-rich settings, credit in resource-scarce ones; given the sample-sensitivity of the branch interaction, this allocation implication is provisional and warrants replication on broader panels. Finally, air-passenger connectivity is a structural, long-cycle lever, best treated as public investment rather than stabilization policy.

Four limitations apply: the air-traffic series cut the moderation sample from 336 to 249 observations; resource dependence is treated as exogenous (defensible for the static average, weaker dynamically); the estimates are descriptive, not causal; and the branches × resource-dependence interaction is sensitive to sample composition, so the moderation evidence – though directionally stable – remains suggestive. Extending the design to resource-dependent non-transition economies (e.g., Indonesia, Brazil) is a natural next step.

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Writing – review & editing: Vugar Nazarov, Jamal Hajiyev, Vasif Ahadov, Aziz İskandarov, Shabnem Dadaşova, Farid Aghababazade, Mayıl Zalıyev.

DATA AVAILABILITY

All data used in this study are publicly available from the World Bank Group databases cited in the text – the World Development Indicators, the Worldwide Governance Indicators, and the Entrepreneurship Database.

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APPENDIX A. Country sample

The sample consists of 28 transition economies covered by the World Bank Group across 2010–2024. Countries are grouped by region; the rightmost column reports the country-level average of total natural resource rents (% of GDP) over 2010–2018, used to construct the static moderation variable in Section 2.

Table A1. Country sample

Region	ISO3	Country	WB income group (FY2024)	Avg rents 2010–2018
Central Europe & Baltics	EST	Estonia	High income	0.32
Central Europe & Baltics	LVA	Latvia	High income	1.18
Central Europe & Baltics	LTU	Lithuania	High income	0.45
Central Europe & Baltics	POL	Poland	High income	1.32
Central Europe & Baltics	CZE	Czech Republic	High income	0.66
Central Europe & Baltics	SVK	Slovakia	High income	0.32
Central Europe & Baltics	HUN	Hungary	High income	0.62
Central Europe & Baltics	SVN	Slovenia	High income	0.42
South-Eastern Europe	ROU	Romania	High income	1.45
South-Eastern Europe	BGR	Bulgaria	Upper middle income	2.30
South-Eastern Europe	HRV	Croatia	High income	0.83
South-Eastern Europe	SRB	Serbia	Upper middle income	1.95
South-Eastern Europe	BIH	Bosnia and Herz.	Upper middle income	2.60
South-Eastern Europe	MNE	Montenegro	Upper middle income	1.10
South-Eastern Europe	MKD	North Macedonia	Upper middle income	1.40
South-Eastern Europe	ALB	Albania	Upper middle income	3.15
South-Eastern Europe	XKX	Kosovo	Upper middle income	2.85
Eastern Europe	UKR	Ukraine	Lower middle income	3.50
Eastern Europe	MDA	Moldova	Upper middle income	0.24
Eastern Europe	BLR	Belarus	Upper middle income	1.22
Eastern Europe	RUS	Russian Fed.	Upper middle income	13.50
Caucasus	AZE	Azerbaijan	Upper middle income	23.82
Caucasus	ARM	Armenia	Upper middle income	2.90
Caucasus	GEO	Georgia	Upper middle income	1.10
Central Asia	KAZ	Kazakhstan	Upper middle income	20.10
Central Asia	KGZ	Kyrgyz Republic	Lower middle income	5.50
Central Asia	TJK	Tajikistan	Lower middle income	3.80
Central Asia	UZB	Uzbekistan	Lower middle income	8.20

Note: Income-group classifications follow the World Bank country and lending groups for fiscal year 2024. Avg rents = mean of total natural resource rents (% of GDP), 2010–2018.

APPENDIX B. Correlation matrix

Pearson correlations among the 17 variables used in the analysis. Bolded entries indicate $|r| \geq 0.50$.

Table B1. Correlation matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) FDI (% GDP)	–																
(2) GFCF (% GDP)	0.11	–															
(3) NBD	0.08	–0.04	–														
(4) ATMs	–0.05	–0.41	0.41	–													
(5) Branches	0.02	–0.20	0.15	0.31	–												
(6) Credit (% GDP)	0.04	–0.29	0.43	0.51	0.32	–											
(7) Air pass (n)	–0.07	–0.08	–0.08	0.55	0.02	0.08	–										
(8) Air freight	–0.14	–0.12	–0.09	0.51	0.03	0.06	0.86	–									
(9) ln(air pass/WA)	0.09	–0.00	0.22	0.26	0.01	0.08	0.32	0.17	–								
(10) ln(air frt/WA)	–0.11	–0.12	–0.15	0.18	–0.10	–0.07	0.43	0.47	0.42	–							
(11) Broadband	0.01	–0.11	0.47	0.34	0.13	0.34	0.09	–0.00	0.29	0.01	–						
(12) GDP pc	–0.01	–0.19	0.41	0.33	–0.01	0.36	0.11	0.02	0.27	0.15	0.68	–					
(13) Trade (% GDP)	0.06	–0.09	0.31	–0.03	–0.07	0.35	–0.23	–0.36	0.12	–0.21	0.58	**0.62**	–				
(14) Natres dyn.	–0.05	0.01	–0.27	0.01	–0.23	–0.32	0.24	0.33	–0.02	0.43	–0.36	–0.21	–0.47	–			
(15) Inflation	–0.06	0.14	–0.13	–0.04	–0.21	–0.30	0.06	0.02	–0.06	0.09	–0.04	–0.16	–0.04	0.23	–		
(16) RQ	0.09	–0.22	0.53	0.16	0.12	0.55	–0.17	–0.18	0.15	–0.08	0.55	0.70	**0.62**	–0.45	–0.39	–	
(17) Resource dep.	–0.06	–0.02	–0.27	0.03	–0.22	–0.35	0.26	0.38	0.00	0.51	–0.33	–0.22	–0.51	**0.94**	0.20	–0.46	–

Note: Correlations are computed on pairwise complete observations. Lower triangular; diagonal omitted. Highest correlations: (14)–(17): r = +0.94 by construction (dynamic vs static resource rents); (7)–(8): r = +0.86 by construction (passengers and freight in absolute counts); (12)–(16): r = +0.70 (GDP per capita and Regulatory Quality).

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APPENDIX C. FDI net inflows regressions (Hungary excluded)

Specifications mirror those in Table 3 but with FDI net inflows as the dependent variable and Hungary excluded as an established financial-account-passthrough outlier. The pooled cross-section shows mostly insignificant coefficients (only broadband marginal at p = 0.063); the between-effects column has no statistically significant predictor; the FE column identifies three significant within-country correlates: trade openness (β = +0.066, p = 0.025), domestic credit (β = −0.035, p = 0.042), and fixed broadband (β = +0.204, p = 0.085, marginal). Air-connectivity measures are insignificant. Within-R^2 reaches 0.142, substantially lower than the 0.260 within-R^2 obtained for new business density, indicating that FDI variation is less well explained by our infrastructure-and-controls vector than entrepreneurial activity.

Table C1. FDI net inflows (% GDP), Hungary excluded

Variable	Pooled OLS	Between Eff.	Fixed Eff.
ATMs per 100k adults	−0.004	−0.045	−0.011
	(0.010)	(0.027)	(0.018)
Bank branches per 100k adults	0.013	0.017	0.000
	(0.012)	(0.029)	(0.033)
Domestic credit (% GDP)	0.000	0.117	−0.035**
	(0.018)	(0.072)	(0.016)
Fixed broadband per 100	−0.069*	−0.093	0.204*
	(0.035)	(0.071)	(0.113)
ln(air passengers / WA)	0.131	1.358	−0.128
	(0.333)	(1.111)	(0.430)
ln(air freight ton-km / WA)	−0.062	−0.323	0.163
	(0.113)	(0.283)	(0.258)
Trade (% GDP)	0.012	−0.011	0.066**
	(0.012)	(0.019)	(0.027)
Inflation, CPI (% YoY)	0.039	0.194	0.016
	(0.035)	(0.242)	(0.047)
Regulatory Quality (WGI)	0.877	0.841	−1.398
	(0.809)	(1.644)	(1.564)
N	249	23	249
R^2	0.072	0.407	0.451
R^2 Within	–	–	0.142

Note: Dependent variable: FDI net inflows (% GDP). Hungary excluded throughout. Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10. Cluster-robust SE at the country level for pooled OLS and FE; heteroskedasticity-robust SE for between-effects.

APPENDIX D. Gross fixed capital formation regressions

Gross fixed capital formation as a share of GDP is regressed on the same set of indicators. The fixed-effects column reveals no statistically significant predictor (within-R^2 = 0.089), confirming that within-country fluctuations in aggregate investment respond mostly to factors outside our infrastructure-and-controls vector – plausibly to monetary-policy stance, fiscal cycles, and country-specific shocks not absorbed by the year fixed effect alone. The pooled and between-effects columns, however, show a striking contrast on air connectivity: passengers per WA enter positive and significant (Pooled: β = +1.325, p = 0.017; Between: β = +1.167, p = 0.026), while freight per WA enters negative and significant in the

pooled column (β = −0.534, p = 0.006) and marginally in BE (β = −0.572, p = 0.090). The cross-sectional asymmetry between passenger and freight aviation is consistent with passenger flights proxying business-mobility and service-economy intensity (positively associated with capital deepening), and freight intensity proxying export-platform manufacturing concentrated in capital-imported sectors.

Table D1. Gross fixed capital formation (% GDP)

Variable	Pooled OLS	Between Eff.	Fixed Eff.
ATMs per 100k adults	−0.051*	−0.053	−0.022
	(0.027)	(0.040)	(0.026)
Bank branches per 100k adults	0.001	−0.031	0.035
	(0.041)	(0.047)	(0.056)
Domestic credit (% GDP)	−0.003	−0.021	0.018
	(0.037)	(0.098)	(0.049)
Fixed broadband per 100	0.044	0.052	−0.018
	(0.087)	(0.147)	(0.162)
ln(air passengers / WA)	1.325**	1.167**	1.124
	(0.514)	(0.467)	(0.809)
ln(air freight ton-km / WA)	−0.534***	−0.572*	0.160
	(0.177)	(0.315)	(0.414)
Trade (% GDP)	−0.011	−0.019	0.002
	(0.022)	(0.024)	(0.055)
Inflation, CPI (% YoY)	0.078	0.127	0.083
	(0.078)	(0.451)	(0.070)
Regulatory Quality (WGI)	−1.601	−0.739	4.491
	(1.170)	(1.807)	(2.786)
N	254	24	254
R^2	0.246	0.465	0.664
R^2 Within	–	–	0.089

Note: Dependent variable: GFCF (% GDP). Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10. Cluster-robust SE at the country level for pooled OLS and FE; heteroskedasticity-robust SE for between-effects.

APPENDIX E. Marginal effects at reference countries (Spec D3)

Table E1 reports the marginal effects of bank branches per 100,000 adults and domestic credit (% GDP) on ln(new business density), evaluated at four reference countries representing the empirical range of resource dependence: Azerbaijan and Kazakhstan (high-resource Caspian basin) versus the Czech Republic and Moldova (low-resource). The marginal effects are computed by recentering the moderator at each country's value and refitting Specification D3 to obtain the coefficient interpretation at that country's resource-rent intensity, with cluster-robust standard errors propagated through to the marginal-effect inference.

The result is a bidirectional pattern. In the Caspian economies, bank branches have a significantly positive marginal effect on entrepreneurial activity (Azerbaijan: ME = +0.0376, p = 0.002; Kazakhstan: ME = +0.0332, p = 0.002), while credit's marginal effect is negative but only borderline (p ≈ 0.10-0.12). In the resource-scarce economies, the signs reverse and both reach statistical significance: in the Czech Republic and Moldova, branches have a negative marginal effect (CZE: ME = −0.0072, p = 0.062; MDA: ME = −0.0106, p = 0.015) and credit has a positive marginal effect (CZE: ME = +0.0093, p = 0.026; MDA: ME = +0.0116, p = 0.014). The reversal is therefore not Caspian-only – it operates in both directions across the resource-dependence spectrum.

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Table E1. Marginal effects of bank branches and domestic credit on ln(NBD)

Country	Centered rd	ME of bank branches	ME of domestic credit	Interpretation
AZE	2.088	0.0376***	–0.0212	Caspian: branches positive (***); credit negative (n.s., p ≈ 0.10)
		(0.0105)	(0.0125)	
KAZ	1.815	0.0332***	–0.0182	Caspian: branches positive (***); credit negative (n.s., p ≈ 0.12)
		(0.0095)	(0.0113)	
CZE	–0.697	–0.0072*	0.0093**	Low resource: branches negative (*); credit positive (**)
		(0.0037)	(0.0039)	
MDA	–-0.907	–0.0106**	0.0116**	Low resource: branches negative (**); credit positive (**)
		(0.0040)	(0.0044)	

Note: Marginal effects estimated by recentering rd_centered at the reference country's value and refitting Specification D3 (FE with country and year fixed effects, branches × R and credit × R as the only interactions). Standard errors clustered at the country level. *** p < 0.01, ** p < 0.05, * p < 0.10. Centered rd is the country's value of ln(1 + average natural resource rents 2010–2018) minus the sample mean (centering constant = 1.123).

APPENDIX F. Sample coverage and missingness

This appendix documents the coverage of the unbalanced panel. Table F1 reports, for each economy, the country-years available for the key series and the number entering the complete-case new-business-density estimation sample (of 15 possible). Four economies – Albania, North Macedonia, Slovakia, and Kosovo – contribute no observations, in every case because the air-freight series is unavailable for them (Kosovo additionally lacks broadband and regulatory-quality data). Table F2 compares full-sample and complete-case descriptive statistics; the two samples differ only marginally, indicating that the listwise-deletion sample is broadly representative and that missingness is not systematically related to the level of any key variable.

Table F1. Country-years available and contribution to the estimation sample, by economy

ISO	Region	Est. N	Air pass	Air frt	B-band	RQ
ALB	SE-Europe	0	13	0	15	14
XKX	SE-Europe	0	0	0	0	0
SVK	CE&Balt	0	7	0	15	14
MKD	SE-Europe	0	0	0	15	14
MNE	SE-Europe	4	12	5	15	14
BIH	SE-Europe	5	5	6	15	14
HUN	CE&Balt	5	14	5	15	14
EST	CE&Balt	7	9	7	15	14
TJK	C-Asia	7	14	14	13	14
BLR	E-Europe	8	14	14	15	14
UKR	E-Europe	8	13	13	15	14
AZE	Caucasus	8	14	14	15	14
KAZ	C-Asia	8	14	14	15	14
ARM	Caucasus	9	10	9	15	14
LTU	CE&Balt	10	13	11	15	14
UZB	C-Asia	10	14	14	15	14
SVN	CE&Balt	10	12	10	15	14
RUS	E-Europe	12	14	14	15	14
HRV	SE-Europe	12	14	14	15	14
LVA	CE&Balt	14	14	14	15	14
BGR	SE-Europe	14	14	14	14	14
CZE	CE&Balt	14	14	14	15	14
KGZ	C-Asia	14	14	14	15	14
GEO	Caucasus	14	14	14	15	14
MDA	E-Europe	14	14	14	15	14

Table F1 (cont.). Country-years available and contribution to the estimation sample, by economy

ISO	Region	Est. N	Air pass	Air frt	B-band	RQ
SRB	SE-Europe	14	14	14	15	14
POL	CE&Balt	14	14	14	15	14
ROU	SE-Europe	14	14	14	15	14

Note: Cells give the number of country-years (of 15) with non-missing data for each series; Est. N is the number entering the complete-case new-business-density estimation sample. Albania, North Macedonia, Slovakia, and Kosovo contribute zero, in every case because air-freight data are unavailable (Kosovo also lacks broadband and Regulatory Quality).

Table F2. Full-sample versus complete-case descriptive statistics

Variable	Full N	Full mean	Full SD	CC N	CC mean	CC SD
New business density	405	4.75	4.89	249	4.70	4.24
ATMs per 100k	385	63.99	29.93	249	68.08	33.23
Bank branches per 100k	383	23.76	14.57	249	25.32	15.92
Domestic credit (% GDP)	395	43.23	15.89	249	43.36	17.05
Broadband per 100	402	20.64	9.58	249	20.04	8.95
ln(air pass/WA)	332	–1.31	1.34	249	–1.20	1.14
ln(air freight/WA)	290	–13.99	2.37	249	–14.07	2.37
Trade (% GDP)	419	106.39	35.58	249	104.28	32.27
Inflation (% YoY)	411	5.18	6.28	249	5.87	7.26
Regulatory Quality	378	0.23	0.73	249	0.27	0.73
GDP per capita (2015 USD)	420	8,922	6,038	249	8,998	5,825
Resource rents (% GDP)	336	3.75	6.15	219	3.69	5.51
Resource dependence (avg)	420	3.76	5.77	249	3.91	5.70

Note: Full = all available country-years; CC = the 249-observation complete-case estimation sample. N = non-missing observations. Means and standard deviations differ only marginally between the two samples.

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