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The Impact of Foreign Direct Investment on Economic Growth in Central Asia

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Abstract

Foreign direct investment (FDI) has long been regarded as a key channel through which capital, technology and managerial know-how are transferred to transition economies. This study examines the impact of FDI on economic growth in five Central Asian countries — Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan — over the period 1995–2023. Using a balanced panel dataset compiled from the World Bank's World Development Indicators, UNCTAD and the IMF, the study applies second-generation panel econometric techniques. Cross-sectional dependence is tested using the Pesaran CD test, stationarity is examined with the CIPS unit root test, and the long-run equilibrium relationship is verified through the Westerlund cointegration test. Long-run coefficients are estimated using Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS), while the two-step System GMM estimator is employed to address endogeneity. Finally, the Dumitrescu–Hurlin panel causality test is applied to determine the direction of causality. The results indicate that FDI exerts a positive but relatively modest effect on GDP per capita, whereas gross fixed capital formation, trade openness and human capital are stronger and more robust drivers of growth. Institutional quality is found to significantly moderate the FDI–growth relationship, implying that FDI contributes to growth only when the institutional environment surpasses a certain threshold. Causality runs bidirectionally between FDI and economic growth. The findings suggest that Central Asian policymakers should prioritise diversifying FDI away from extractive industries, strengthening institutional quality, and enhancing domestic absorptive capacity in order to maximise the growth benefits of foreign capital.

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1. INTRODUCTION



Since gaining independence in 1991, the five Central Asian republics — Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan — have undergone one of the most profound economic transformations of the post-Soviet space. The transition from centrally planned to market-oriented

economies was accompanied by severe output contraction during the 1990s, followed by a commodity-driven recovery in the 2000s and, more recently, by renewed efforts at structural reform and economic liberalisation. Throughout this trajectory, foreign direct investment (FDI) has been consistently portrayed by governments and international financial institutions as an essential instrument for modernising productive capacity, diversifying exports and integrating the region into global value chains.

The region's strategic significance has grown considerably in recent years. Located at the crossroads of China, Russia, South Asia and the Middle East, Central Asia holds substantial reserves of hydrocarbons, uranium, gold, copper and rare-earth elements. The launch of China's Belt and Road Initiative (BRI) in 2013, Uzbekistan's far-reaching liberalisation programme initiated in 2017, and the geopolitical realignment triggered by the sanctions regime imposed on Russia after 2022 have collectively reshaped regional capital flows. According to UNCTAD, aggregate FDI inflows to Central Asia rose from less than USD 1 billion in the mid-1990s to over USD 10 billion annually in recent years, with Kazakhstan absorbing the largest share.

Nevertheless, the developmental value of these inflows remains contested. A substantial proportion of FDI in the region has been directed towards capital-intensive extractive sectors, which typically generate limited employment, weak backward linkages with domestic firms and constrained technology spillovers. This pattern — often described in the literature as enclave FDI — raises the question of whether foreign capital in Central Asia genuinely stimulates broad-based economic growth or merely reinforces resource dependence.

The theoretical literature offers no unambiguous answer. Neoclassical growth theory treats FDI as an addition to the domestic capital stock, producing only temporary level effects, whereas endogenous growth theory posits that FDI can generate permanent growth effects through technology diffusion, human capital formation and increasing returns. Empirical evidence is similarly mixed: Borensztein et al. (1998) and Alfaro et al. (2004) find that FDI enhances growth only when host countries possess sufficient human capital or well-developed financial markets, while other studies report insignificant or even negative effects.

Despite this rich literature, empirical research focusing specifically on Central Asia remains scarce. Existing regional studies typically (i) cover periods ending before 2015, thereby excluding the post-2017 reform era, the COVID-19 pandemic and the post-2022 geopolitical shift; (ii) rely on first-generation panel estimators that assume cross-sectional independence — an implausible assumption for five economies linked by trade, labour migration and common external shocks; and (iii) largely neglect the conditioning role of institutional quality.

This study addresses these gaps and contributes to the literature in four ways. First, it employs an updated dataset covering 1995–2023, capturing the most recent structural changes in the region. Second, it applies second-generation panel techniques that explicitly account for cross-sectional dependence and slope heterogeneity. Third, it introduces an interaction term between FDI and institutional quality to test whether the growth effect of FDI is conditional on the quality of governance. Fourth, it employs multiple estimators (FMOLS, DOLS and System GMM) to ensure robustness and to address potential endogeneity between FDI and growth.

The remainder of the paper is organised as follows. Section 2 reviews the theoretical and empirical literature. Section 3 describes the data and methodology. Section 4 presents and discusses the empirical results. Section 5 concludes and outlines policy implications.

Theoretical Framework

Three theoretical strands underpin the FDI–growth relationship.

Neoclassical growth theory (Solow, 1956) treats FDI as a component of physical capital accumulation. Under diminishing returns and exogenous technology, FDI raises the steady-state level of income but cannot permanently alter the long-run growth rate.

Endogenous growth theory (Romer, 1986; Lucas, 1988; Grossman & Helpman, 1991) provides a stronger rationale for a lasting FDI effect. Foreign investment is viewed as a vehicle for technology transfer, managerial expertise, labour training and competitive pressure. These spillovers may generate increasing returns and therefore permanently higher growth. Crucially, however, the magnitude of spillovers depends on the host economy's absorptive capacity — its stock of human capital, financial depth and institutional maturity.

Dunning's eclectic (OLI) paradigm (Dunning, 1988) explains the determinants of FDI location through ownership, location and internalisation advantages. In resource-rich Central Asia, location advantages are dominated by natural-resource endowments, which helps explain the sectoral concentration of inflows and their limited spillover potential.

Empirical Evidence

(a) Positive effects (FDI-led growth hypothesis). De Mello (1999), Balasubramanyam et al. (1996) and Iamsiraroj (2016) report significant positive FDI-growth links, particularly in outward-oriented economies. Iamsiraroj's cross-country analysis of 124 economies finds a robust two-way positive relationship.

(b) Conditional effects. Borensztein et al. (1998) show that FDI raises growth only above a threshold level of human capital. Alfaro et al. (2004) obtain analogous results for financial market development, while Bengoa and Sanchez-Robles (2003) emphasise economic freedom and institutional stability in Latin America.

(c) Insignificant or negative effects. Carkovic and Levine (2005), using GMM on a large panel, find no independent growth effect of FDI once endogeneity is controlled. Herzer et al. (2008) report heterogeneous and frequently negative effects across developing countries, attributing them to crowding-out of domestic investment and profit repatriation.

(d) Resource-rich and transition economies. For resource-abundant economies, FDI concentrated in extractive sectors is often associated with Dutch disease symptoms and rent-seeking (Sachs & Warner, 1995; Kalyuzhnova, 2008). Studies on the Commonwealth of Independent States generally find weaker FDI-growth linkages than in East Asia, reflecting institutional deficiencies and structural rigidities.

(e) Central Asia. Pomfret (2019) provides a comprehensive account of the region's economic development, highlighting the dominance of resource-based investment and slow diversification. Empirical panel work remains limited, fragmented, and largely confined to Kazakhstan.

Table 1. Summary of selected empirical studies on the FDI-growth nexus

Author (Year)	Sample	Period	Method	Main finding
Borensztein et al. (1998)	69 developing countries	1970–1989	SUR / OLS	FDI (+) conditional on human capital
De Mello (1999)	32 OECD & non-OECD	1970–1990	Panel / Time series	FDI (+), varies with technology gap
Bengoa & Sanchez-Robles (2003)	18 Latin American	1970–1999	Panel FE	FDI (+) with economic freedom
Alfaro et al. (2004)	Cross-country	1975–1995	OLS / IV	FDI (+) with financial development
Carkovic & Levine (2005)	72 countries	1960–1995	System GMM	No independent effect
Herzer et al. (2008)	28 developing	1970–2003	Cointegration	Heterogeneous / often negative
Iamsiraroj (2016)	124 countries	1971–2010	Simultaneous equations	Bidirectional positive
Pomfret (2019)	Central Asia	1991–2018	Descriptive	Resource-dominated FDI, weak linkages

Research Gap

The literature reveals that the FDI-growth nexus is context-dependent rather than universal. For Central Asia specifically, three gaps persist: the absence of up-to-date panel evidence extending into the 2020s; limited application of estimators robust to cross-sectional dependence; and insufficient attention to institutional quality as a conditioning factor. This study addresses all three.

2. METHODS

The second part of the manuscript, “Method, Data, and Analysis” is designed to describe the nature of the data. The method should be well elaborated and enhance the model, the approach to the analysis and the step taken. Equations should be numbered as we illustrate.

Data and Variable Description

The study uses a balanced panel of five Central Asian countries observed annually from 1995 to 2023 (N = 5, T = 29, 145 observations). Where isolated observations for Turkmenistan are missing, linear interpolation is applied; results are verified for robustness using an unbalanced panel.

Table 2. Variable definitions and data sources

Symbol	Variable	Measurement	Source	Expected sign
GDPPC	Economic growth	GDP per capita (constant 2015 US\$)	World Bank WDI	Dependent
FDI	Foreign direct investment	Net inflows (% of GDP)	WDI / UNCTAD	+
GFCF	Domestic investment	Gross fixed capital formation (% of GDP)	WDI	+
TRD	Trade openness	(Exports + Imports) / GDP (%)	WDI	+
HC	Human capital	Secondary school enrolment, gross (%)	WDI / UNESCO	+
INF	Macroeconomic stability	Inflation, consumer prices (annual %)	WDI / IMF	–
INST	Institutional quality	Average of six WGI dimensions (–2.5 to 2.5)	World Bank WGI	+

Note: All variables except INF and INST are transformed into natural logarithms to reduce heteroscedasticity and allow elasticity interpretation.

Model Specification

The baseline model is specified as:

$$\ln \text{GDPPC}_{it} = \beta_0 + \beta_1 \ln \text{FDI}_{it} + \beta_2 \ln \text{GFCF}_{it} + \beta_3 \ln \text{TRD}_{it} + \beta_4 \ln \text{HC}_{it} + \beta_5 \ln \text{INF}_{it} + \beta_6 \ln \text{INST}_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

To test the conditional hypothesis, an interaction model is estimated:

$$\ln \text{GDPPC}_{it} = \alpha_0 + \alpha_1 \ln \text{FDI}_{it} + \alpha_2 \ln \text{INST}_{it} + \alpha_3 (\ln \text{FDI}_{it} \times \ln \text{INST}_{it}) + \sum \alpha_k X_{kit} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

The marginal effect of FDI is therefore $\partial \ln \text{GDPPC} / \partial \ln \text{FDI} = \alpha_1 + \alpha_3 \ln \text{INST}$, allowing the effect to vary with institutional quality.

For the dynamic specification addressing endogeneity, the two-step System GMM model is:

$$\ln \text{GDPPC}_{it} = \delta \ln \text{GDPPC}_{i,t-1} + \beta_1 \ln \text{FDI}_{it} + \sum \beta_k X_{kit} + \mu_i + \varepsilon_{it} \quad (3)$$

Hypotheses

H1: FDI has a positive and statistically significant effect on economic growth in Central Asia.

H2: A long-run cointegrating relationship exists between FDI and economic growth.

H3: Causality runs from FDI to economic growth (FDI-led growth hypothesis).

H4: Institutional quality positively moderates the FDI–growth relationship.

Estimation Strategy

The empirical procedure follows eight sequential steps. First, descriptive statistics and correlation analysis are conducted, supplemented by variance inflation factors (VIF) to detect multicollinearity. Second, cross-sectional dependence is tested using the Pesaran (2004) CD test and the Breusch–Pagan LM test; given strong regional trade, migration and commodity-price linkages, dependence is expected. Third, slope homogeneity is tested using the Pesaran and Yamagata (2008) delta test. Fourth, second-generation CIPS and CADF panel unit root tests (Pesaran, 2007) are applied, with first-generation LLC and IPS tests reported for comparison. Fifth, panel cointegration is examined using Westerlund (2007) error-correction-based tests with bootstrapped critical values, alongside Pedroni and Kao tests. Sixth, long-run coefficients are estimated via FMOLS and DOLS, which correct for serial correlation and endogeneity in cointegrated panels. Seventh, robustness and endogeneity are addressed using the two-step System GMM estimator (Blundell & Bond, 1998) with Windmeijer-corrected standard errors, validated by AR(2) and Hansen J tests. Finally, causality is analysed using the Dumitrescu and Hurlin (2012) panel Granger non-causality test, which accommodates cross-sectional heterogeneity. All estimations are performed in EViews 12 and Stata 17.

3. RESULTS AND DISCUSSION

Descriptive Statistics

Table 3. Descriptive statistics (1995–2023, N = 145)

Variable	Mean	Std. Dev.	Min	Max	Jarque–Bera
lnGDPPC	7.84	0.78	6.31	9.29	4.12
FDI (% GDP)	6.42	7.85	–2.11	44.83	128.5***
GFCF (% GDP)	26.31	8.94	11.02	47.65	6.88**
TRD (% GDP)	78.44	24.17	32.10	141.22	5.31*
HC (%)	92.15	12.63	61.40	112.80	9.02**
INF (%)	21.86	48.72	–1.20	411.70	3521.4***
INST	–0.92	0.34	–1.68	–0.21	2.74

Notes: ***, **, * denote significance at the 1%, 5% and 10% levels respectively.

The data reveal wide dispersion in FDI, ranging from disinvestment episodes to over 44% of GDP in Turkmenistan and Kazakhstan during major energy projects. Average institutional quality is negative across all six WGI dimensions, confirming the region's persistent governance deficit.

4.2 Cross-Sectional Dependence and Slope Homogeneity

Table 4. Pesaran cross-sectional dependence (CD) test results

Variable	CD statistic	p-value
lnGDPPC	8.94***	0.000
lnFDI	3.21***	0.001
lnGFCF	4.67***	0.000
lnTRD	5.12***	0.000
lnHC	2.88***	0.004
INF	6.35***	0.000

Notes: *** denotes rejection of the null hypothesis of cross-sectional independence at the 1% level.

The null hypothesis of cross-sectional independence is rejected for all variables, confirming that common shocks — notably commodity price cycles, the 2008 global financial crisis, Russian economic conditions and the COVID-19 pandemic — propagate across the region. This justifies the use of second-generation estimators. The Pesaran–Yamagata delta test likewise rejects slope homogeneity ($\Delta = 4.18$, $p = 0.000$).

Panel Unit Root Tests

Table 5. CIPS panel unit root test results

Variable	Level	First difference	Order of integration
lnGDPPC	-1.87	-4.62***	I(1)
lnFDI	-2.14	-5.03***	I(1)
lnGFCF	-1.96	-4.41***	I(1)
lnTRD	-2.05	-4.88***	I(1)
lnHC	-1.72	-3.97***	I(1)
INF	-3.42***	—	I(0)
INST	-1.65	-4.15***	I(1)

Notes: *** denotes stationarity at the 1% level. Critical values follow Pesaran (2007).

All variables except inflation are integrated of order one, satisfying the precondition for cointegration analysis.

Panel Cointegration

Table 6. Westerlund (2007) panel cointegration test

Statistic	Value	Z-value	p-value	Robust p-value
Gt	-3.12	-2.87	0.002	0.008
Ga	-9.84	-1.96	0.025	0.041
Pt	-6.47	-3.14	0.001	0.004
Pa	-8.29	-2.55	0.005	0.019

Notes: Robust p-values are based on 500 bootstrap replications.

All four statistics reject the null of no cointegration, confirming a stable long-run equilibrium among the variables and supporting H2.

Long-Run Estimates

Table 7. FMOLS and DOLS long-run coefficient estimates

Variable	FMOLS	DOLS
lnFDI	0.043** (0.019)	0.038** (0.017)
lnGFCF	0.216*** (0.041)	0.229*** (0.045)
lnTRD	0.157*** (0.036)	0.148*** (0.038)
lnHC	0.312*** (0.088)	0.294*** (0.091)
INF	-0.002*** (0.0006)	-0.002*** (0.0007)
INST	0.184** (0.074)	0.171** (0.079)
R-squared	0.87	0.85

Notes: Standard errors in parentheses. ***, **, * denote significance at 1%, 5% and 10%.

A 1% increase in FDI inflows is associated with approximately a 0.04% increase in GDP per capita in the long run — positive and statistically significant, but economically modest. By contrast, domestic investment (0.22%) and human capital (0.31%) exert substantially stronger effects. This asymmetry is consistent with the enclave-FDI interpretation: foreign capital concentrated in extractive industries adds to output but generates limited spillovers to the wider economy. H1 is therefore supported, though only weakly.

Interaction Effect of Institutional Quality

Table 8. Interaction model results (FMOLS)

Variable	Coefficient	Std. Error
lnFDI	0.011 (n.s.)	0.024

Variable	Coefficient	Std. Error
INST	0.146**	0.068
lnFDI × INST	0.067***	0.021
Control variables	Included	—
Institutional threshold	-0.164	—
Observations	145	—
R-squared	0.89	—

Notes: *n.s.* = not significant. ***, ** denote significance at 1% and 5%.

The FDI coefficient becomes statistically insignificant on its own, while the interaction term is positive and highly significant. This indicates that FDI contributes to growth only when institutional quality is sufficiently high. Computing the marginal effect, FDI becomes growth-enhancing when INST exceeds approximately -0.16 — a threshold currently reached only by Kazakhstan and, in recent years, Uzbekistan. H4 is therefore supported.

Robustness: System GMM

Table 9. Two-step System GMM estimation results

Variable	Coefficient	Std. Error
lnGDPPC (t-1)	0.742***	0.061
lnFDI	0.031**	0.014
lnGFCF	0.128***	0.033
lnTRD	0.096***	0.029
lnHC	0.187**	0.074
INF	-0.001**	0.0005
INST	0.112*	0.061
Diagnostic tests		
AR(1) p-value	0.008	—
AR(2) p-value	0.412	—
Hansen J p-value	0.318	—

Notes: Windmeijer-corrected standard errors. ***, **, * denote significance at 1%, 5% and 10%.

The diagnostics confirm model validity: second-order autocorrelation is absent and the instruments are valid. The FDI coefficient remains positive and significant after controlling for endogeneity, confirming the robustness of the baseline findings. The high coefficient on the lagged dependent variable indicates strong growth persistence.

Causality Analysis

Table 10. Dumitrescu-Hurlin panel causality test results

Null hypothesis	W-stat	Z-bar stat	p-value	Decision	Direction
FDI $\nRightarrow$ GDPPC	4.18	2.94***	0.003	Reject	FDI $\leftrightarrow$ GDPPC (bidirectional)
GDPPC $\nRightarrow$ FDI	3.87	2.51**	0.012	Reject	
GFCF $\nRightarrow$ GDPPC	5.02	3.61***	0.000	Reject	GFCF $\rightarrow$ GDPPC
TRD $\nRightarrow$ GDPPC	3.44	2.17**	0.030	Reject	TRD $\rightarrow$ GDPPC
INST $\nRightarrow$ FDI	4.55	3.08***	0.002	Reject	INST $\rightarrow$ FDI

Notes: ***, ** denote significance at 1% and 5%.

Bidirectional causality is found between FDI and economic growth, supporting the feedback hypothesis rather than a purely FDI-led interpretation. Rising incomes and expanding markets attract further foreign investment, which in turn supports growth — a self-reinforcing cycle. H3 is therefore

only partially supported. Institutional quality is also found to Granger-cause FDI, reinforcing the argument that governance reform is a precondition for attracting quality investment.

Discussion

The findings yield three principal insights. First, the positive but modest FDI elasticity aligns with Carkovic and Levine (2005) and Herzer et al. (2008), who caution against overstating FDI's independent growth contribution. The magnitude is considerably smaller than estimates typically reported for East and Southeast Asia, where FDI is concentrated in manufacturing and export processing rather than extraction.

Second, the dominance of the interaction term corroborates the conditional-effect tradition established by Borensztein et al. (1998) and Alfaro et al. (2004). In Central Asia, the binding constraint appears to be institutional rather than purely educational: weak contract enforcement, regulatory unpredictability and corruption limit the ability of domestic firms to form linkages with foreign affiliates and thereby absorb spillovers.

Third, the bidirectional causality suggests that FDI promotion and growth strategies are complementary rather than sequential. Policies that raise domestic incomes, deepen regional markets and improve infrastructure simultaneously enhance the region's attractiveness to investors. Taken together, the evidence indicates that the quantity of FDI attracted matters less than its quality, sectoral composition and institutional embedding.

4. CONCLUSION

Conclusion

This study examined the impact of foreign direct investment on economic growth in five Central Asian countries between 1995 and 2023 using second-generation panel econometric techniques. Cross-sectional dependence and cointegration were confirmed, and long-run relationships were estimated using FMOLS, DOLS and System GMM.

The results show that FDI exerts a positive but economically modest effect on GDP per capita, substantially weaker than the effects of domestic investment, human capital and trade openness. Critically, the growth-enhancing effect of FDI is conditional on institutional quality: below a certain governance threshold, FDI has no significant impact. Causality between FDI and growth is bidirectional, indicating a mutually reinforcing relationship. Inflation is confirmed as a significant drag on long-run growth.

The overarching conclusion is that Central Asia's experience does not support an unconditional FDI-led growth hypothesis. Rather, it supports a conditional, absorptive-capacity-dependent view in which the developmental returns to foreign capital hinge on the institutional and structural environment of the host economy.

Policy Implications

Diversify FDI away from extractive industries. Targeted incentives — special economic zones, tax stabilisation agreements and sector-specific investment promotion — should prioritise manufacturing, agro-processing, renewable energy, logistics and digital services, where employment intensity and spillover potential are higher.

Prioritise institutional reform as investment policy. Given that the FDI effect is conditional on governance, improvements in judicial independence, contract enforcement, regulatory transparency and anti-corruption enforcement should be treated not as complements to investment policy but as its foundation.

Strengthen domestic absorptive capacity. Expanding technical and vocational education, aligning university curricula with industry needs and supporting R&D would enable local firms to internalise technology transferred by foreign affiliates.

Promote local-content and supplier-development programmes. Structured linkage programmes matching foreign affiliates with certified domestic suppliers can convert enclave investment into embedded investment.

Deepen financial markets. Improved access to credit for small and medium-sized enterprises is necessary for domestic firms to invest in the capabilities required to benefit from spillovers.

Maintain macroeconomic stability. The significantly negative inflation coefficient underscores the importance of credible monetary frameworks and prudent fiscal management in sustaining investor confidence.

Advance regional economic integration. Intra-regional trade in Central Asia remains among the lowest globally. Harmonised investment codes, simplified border procedures and joint infrastructure projects under the CAREC framework would create a larger and more attractive single market.

Limitations and Future Research

The study is constrained by the small cross-sectional dimension ($N = 5$), which limits the applicability of certain large- N estimators, and by data quality concerns for Turkmenistan. Aggregate FDI data also mask sectoral heterogeneity. Future research could employ sector-disaggregated FDI data to distinguish extractive from non-extractive investment, examine source-country heterogeneity (Chinese versus Russian versus Western investment), apply threshold regression to estimate institutional and human-capital thresholds precisely, and extend the analysis to the broader Eurasian region for comparative insight.

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