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THE IMPACT OF TRADE TARIFFS ON ECONOMIC GROWTH IN CENTRAL ASIA: EVIDENCE FROM UZBEKISTAN

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Abstract: This paper investigates the relationship between tariff policies and economic growth in Central Asia, with particular emphasis on Uzbekistan's post-2017 economic reforms. Tariffs may provide temporary protection for domestic industries. However, excessive trade barriers can reduce competitiveness and limit long-run growth. Instrumenting a balanced panel dataset covering Central Asian economies from 1996 to 2023, the study examines how variations in tariff rates affect real GDP growth.

The empirical analysis employs pooled OLS, Fixed Effects, and Driscoll-Kraay estimators while controlling for trade openness, foreign direct investment, inflation, capital formation, labor force participation, population growth, and institutional quality. The results consistently demonstrate a significant negative relationship between tariff rates and economic growth. Additional specifications indicate that Uzbekistan experiences a weaker negative effect compared with neighboring economies, suggesting that recent reforms may have moderated adjustment costs associated with trade liberalization.

The findings support gradual tariff reductions, deeper regional integration, and institutional improvements as important elements of sustainable growth strategies in Central Asia.

Key words: Trade Liberalization, Tariff Policy, Economic Growth, Central Asia, Fixed Effects, Driscoll Kraay Estimation.

1. Introduction

Trade policy has already been highlighted as one of the main factors of economic growth. Among these policies, tariffs play a particularly complex role. From one side, they can protect developing industries, stabilize fiscal revenues, and reduce exposure to external shocks (Krueger, 1997; Rodrik, 2008). However, some scholars argue that, tariffs impact negatively on resource allocation, competitiveness, productivity, and economic growth (Amiti and Konings, 2007; Estevadeordal and Taylor, 2013). Therefore, policymakers encounter to the challenge of balancing these two competing objectives to achieve economic growth. Especially, this discussion can be relevant to Central Asian countries, as enduring impact of central planning economy, limited diversification, and emerging institutional frameworks continue to outline the trade policy and economic growth paths. Noticeably, since the dissolution of the Soviet Union, Central Asian economies have followed markedly different paths in trade liberalization. For instance, Kazakhstan pursued earlier integration through the World Trade Organization (WTO) and regional trade agreements, while Uzbekistan maintained a more gradual and protective path until the recent years. However, since 2017 Uzbekistan has introduced wide-ranging reforms aimed at opening its economy, simplifying tariff structures, and aligning trade policy with international standards. These changes demand high quality research frameworks to

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determine appropriate policy implications, particularly, finding impact of trade tariffs on the economic performance of transition economies with developing institutional environments. Therefore, this study investigates the impact of trade tariffs on economic growth in Central Asia, with a specific focus on Uzbekistan. By employing a panel framework covering the period from 1996 to 2023, empirical analysis aims to identify how variations in tariff rates influence GDP growth, while controlling for institutional quality, investment, population growth and trade openness. The analysis contributes to the existing literature by providing region-specific evidence from post-Soviet transition economies and by offering policy insights on how tariff reforms can foster more inclusive and sustainable growth in Uzbekistan and its neighbor-countries.

2. Literature Review

According to the theoretical estimations, high tariff rates effect economic growth negatively, through different microeconomic factors. Trade barriers are considered to disrupt comparative advantage by shielding inefficient domestic industries and preventing economies from specialization regarding their relative productivity. Scholars estimate these protectionist measures as the obvious barrier factors of productivity and economic growth in the long-run (Krugman and Obstfeld, 2009; Irwin, 1996). In particular, it causes misallocation of resources, and impairs long-term economic growth. Protectionism policies are considered as the main reason of reduction in innovation and efficient operation of domestic firms. The number of cross-country studies investigated causal relationship between open trade and GDP growth. In particular, Frankel and Romer (1999) finds significant positive impact of trade openness on economic growth, instrumenting geography related variables on the econometric model. Similarly, Alcalá and Ciccone (2004), using indicators of trade openness, investigate that zero tariff policy, adjusted for price distortions improves economic productivity dramatically. These findings describe tariff reductions as the feasible policy towards economic growth of the nations. Furthermore, the recent findings also highlight a considerable negative effect of tariffs on macroeconomic development factors. Estevadeordal and Taylor (2013), studying developing countries, show that reducing tariffs on production inputs and capital goods, cause a significant improvement on GDP growth. Amiti, Heise and Weinstein (2020), with highly detailed and disaggregated US dataset, identify that tariffs imposed during recent trade conflicts were almost fully passed through to domestic prices, making a reduction in real income. Fajgelbaum and Khandelwal (2022), analyzing US trade war in 2018 2019, empirically, determine substantial welfare loss, resulted in because of supply-chain disruptions and reciprocal tariffs. Overall, these papers reveal that tariff-induced price increases reduce competitiveness in developing countries.

Moreover, there are number of firm-level research evidences, describe the negative impacts of tariffs on productivity and growth. For example, Pavcnik (2002) shows that trade reforms in Chile boosted productivity because of resource reallocation, firms moved from inefficient operation to the efficient one. Amiti and Konings (2007) demonstrate that reduced input tariffs significantly increase firm productivity by enabling access to higher-quality intermediate goods. And, Goldberg et al. (2010) also indicate that India殿 input-tariff reductions improved production and innovation capabilities tremendously. Similarly, the recent microstudies also support abovementioned findings. For instance, Goldberg, Reed and Khandelwal (2020) show that higher trade protection increases misallocation and suppresses plant-level efficiency. Other scholars, Kandilov and Nguyen (2023), confirm the significant and negative effect of input tariffs on export performance and firm growth. Overall, these findings indicate the multiple channels, such as input variety, competition, innovation reduction, technology diffusion, through which tariffs can impact macroeconomic factors of growth negatively.

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Recent research also highlights how tariffs shape a country's position in global value chains (GVCs). Alfaro and Chor (2020) demonstrate that integration into GVCs fosters structural transformation, investment expansion, and productivity improvements. Tariffs restrict participation in GVCs by raising input costs and reducing export competitiveness and limiting economic opportunities, especially in developing countries. Therefore, this literature supports the econometric evidence to analyze impact of tariffs in Central Asian countries, and Uzbekistan in particular, as results can be useful for the tariff related appropriate policy implication, which may improve GVC integration, export performance and, mainly, economic growth. Nevertheless, other empirical studies also reveal that, not all countries experience the same growth effects from tariff changes. Adjustment frictions can weaken short-run benefits (Topalova, 2010), and institutional factors including governance, democracy, and political reforms considered to play a central role (Rodrik, 2008). This reflects the finding in the literature that transition economies undergoing gradual reform, with partial state control and targeted industrial policies, experience moderated tariff effects, in frequent cases. Recent empirical work, instrumenting dataset from 2020 to 2024, analyzing trade shocks in China and Brazil (Bai et al., 2022) similarly shows that the impact of trade policy depends heavily on structural conditions and quality of institutions. However, academic research on Central Asia's trade policy remains limited despite of the region's transition path reveals slow integration into global markets, uneven institutional development, and extensive state involvement. Also, Uzbekistan's post-2017 reform iniciatives, including tariff simplification, exchange-rate liberalization, and investment reforms can be inevitable reasons to study these regions so as to give reliable policy advices with clear econometric justifications. Moreover, this study provides new empirical evidence, with high-quality applied econometric research, as for chosen countries, related literature is limited.

3. Methodology

3.1 Model Specification

The baseline empirical model is:

$$Growth_{it} = \beta_1 Tariff_{it} + X_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it}$$

On this equation, $Growth_{it}$ is real GDP growth, $Tariff_{it}$ is the average applied tariff rate, X_{it} includes control variables, including FDI inflows, inflation, trade openness, gross capital formation, labour force participation, population growth, and institutional quality indexes. And, μ_i captures country-specific factors, λ_t stands for global shocks, ε_{it} is the error term.

Moreover, in order to investigate whether Uzbekistan responds differently to tariff changes, the following interaction specification is estimated:

$$Growth_{it} = \beta_1 Tariff_{it} + \beta_2 UZB_i + \beta_3 (Tariff_{it} \times UZB_i) + \varepsilon_{it}$$

This allows the marginal effect of tariffs to vary between Uzbekistan and the rest of the sample.

3.2 Pooled OLS as a Benchmark

The analysis begins with pooled Ordinary Least Squares (OLS). This approach provides an intuitive benchmark that captures unconditional correlations across the panel. Pooled OLS is widely reported in empirical openness growth studies as an initial comparison point before introducing fixed

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effects or robust inference corrections (Wacziarg & Welch, 2008). While pooled OLS cannot control for unobserved country-specific heterogeneity, it remains useful for two reasons:

1. Baseline interpretability pooled OLS quantifies the raw cross-sectional association between tariffs and growth.

2. Comparability it allows direct comparison with previous studies that rely on cross-country or pooled estimates (Frankel & Romer, 1999).

However, pooled OLS alone cannot be sufficient tool, considering unobservable structural characteristics, such as geography, institutional legacy, or development stage, which effect on economic growth, may bias estimates.

3.3 Fixed Effects (FE) Model

To address time-invariant unobserved heterogeneity, the study employs country fixed effects (FE). FE estimation is appropriate because tariff rates and growth outcomes may be influenced by structural features that do not change over time (including resource endowments, institutional evolution, geographic location). The FE estimator removes such bias by differencing out μ_i.

The Hausman test result ($\chi^2 = 11.19$, $p < 0.01$) indicates that the regressors are correlated with unobserved country-specific characteristics, validating the use of the Fixed-Effects estimator. This finding is important for the interpretation of tariff effects, because the tariff coefficient remains consistently negative and of similar magnitude (approximately −0.71) when moving from pooled OLS to FE and then to FE with Driscoll–Kraay corrections. The stability of the tariff coefficient across these progressively more robust specifications suggests that the negative relationship between tariffs and growth is not driven by omitted time-invariant heterogeneity. Instead, it reflects a genuine within-country effect whereby higher tariffs systematically reduce economic growth. The Hausman result therefore, rejects the null hypothesis of Random Effects consistency ($\chi^2 = 11.19$, $p < 0.01$), confirming that the Fixed-Effects model provides the more reliable estimates. This is consistent with the broader trade literature, which often instruments FE model in growth analysis with the response to policy variables (Rodriguez & Rodrik, 2001).

3.4 Driscoll Kraay Fixed Effects: Robust Inference for Macro Panels

Because of common issues in macroeconomic panels as countries experience shared global shocks (oil prices, recessions, commodity cycles), standard errors in a fixed effects model can be biased. These issues cause heteroskedasticity, autocorrelation, and dependence across cross-sectional units. In order to address these problems, Fixed Effects with Driscoll Kraay (DK) standard errors method is implemented. This model provides robust results, considering heteroskedasticity, autocorrelation, cross-sectional dependence and consistency even with small T(years) and moderate N (Central Asian countries). Driscoll Kraay standard errors are widely recommended for macro-panel studies (Hoechle, 2007). The xtscc estimator in Stata specifically implements FE + DK and is broadly used in modern empirical trade, development, and macroeconomic research.

3.5 Log Tariff Model: Capturing Non-Linearity

Tariff changes often exhibit diminishing or non-linear growth effects, particularly when tariff rates are already low. To account for this, the analysis estimates a log-transformed tariff model, using:

$\log(1 + Tariff)$

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This functional form is recommended in studies where tariff rates include zero or small positive values and where proportional changes matter more than absolute ones (Estevadeordal & Taylor, 2013). Apparently, analysis with the log specification yields a strong, significant coefficient (5.509***), confirming non-linear negative effects.

Moreover, recent papers (Fajgelbaum and Khandelwal, 2022; Amiti et al., 2020; Goldberg et al., 2020) similarly use fixed-effects model with robust cluster or DK-style corrections in their empirical analysis. Thus, FE + DK is the most credible estimator for consistent inference.

4. Data and Variable Selection

This study constructs a balanced panel dataset for Central Asian economies over multiple years (1996-2023) in order to evaluate how trade tariffs influence real GDP growth. All variables were selected based on established growth theory, empirical evidence in international economics, and the specific policy relevance of Uzbekistan殷 recent trade reforms. Data were obtained from reputable, internationally recognized sources including the World Bank殷 *World Development Indicators* (WDI), and the Worldwide Governance Indicators (WGI). Moreover, precise dataset for average applied tariff variable is inquired from the Ministry of Investment and International Trade of Uzbekistan.

4.1 Dependent Variable

Real GDP Growth (annual %)

Real GDP growth is used as the dependent variable because it provides a direct and widely accepted measure of short-run and medium-run economic performance. Furthermore, this aligns with the growth effects explored in the theoretical and empirical trade literature (Frankel and Romer, 1999; Wacziarg and Welch, 2008). Using growth rather than GDP levels avoids persistent country-specific biases and enables interpretation in terms of annual changes, which is suitable for panel fixed-effects estimation.

4.2 Key Explanatory Variable

Tariff Rate (simple average applied tariff)

The tariff rate is the primary policy variable of interest. It captures the degree of trade protection imposed by each country for each year. Tariffs directly affect import costs, competitiveness, input access, and technological adoption, all of which influence economic growth. This measurement is commonly used in empirical studies, examining trade reforms and economic development (Estevadeordal and Taylor, 2013). Using simple average tariffs, rather than weighted rates, avoids distortions caused by fluctuations in import composition and enables consistent cross-country comparisons.

4.3 Interaction Variable

Uzbekistan Dummy + Tariff × Uzbekistan Interaction

A country dummy is introduced to identify whether Uzbekistan殷 growth response differs from other Central Asian economies. The interaction term captures the heterogeneity in tariff effects arising from Uzbekistan殷 post-2017 liberalisation programme, which involved tariff simplification, exchange

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rate reform, and investment liberalisation. This structure follows established empirical approaches that test differential policy impacts across countries or regions (Topalova, 2010).

3.4 Control Variables

The model includes a set of macroeconomic controls widely used in growth regressions. Each variable is selected to minimise omitted-variable bias and isolate the independent effect of trade tariffs.

Trade Openness (% of GDP)

Trade openness, measured as (exports + imports) relative to GDP, captures a country殷 integration into global markets. It is included because openness influences competitiveness, market size, and productivity factors of growth. Excluding it could bias the tariff coefficient since openness and tariff policy often move together.

Foreign Direct Investment (FDI, % of GDP)

FDI is included due to its role in transferring capital, technology, and managerial expertise. Higher FDI inflows often stimulate productivity growth and complement trade reforms. Its omission would cause confounding the tariff effect with external investment patterns.

Inflation (annual %)

Inflation is controlled for as a measure of macroeconomic stability. High and volatile inflation can depress growth by reducing investment incentives and distort price signals. This variable ensures that the tariff coefficient is not capturing the impact of macro instability.

Gross Capital Formation (% of GDP)

Gross capital formation reflects investment in physical capital, a core determinant of long-run GDP growth in neoclassical and endogenous growth models. Controlling for domestic investment helps separate the impact of tariffs from capital accumulation differences across countries.

Labour Force Participation Rate (%)

These variable captures labour supply availability and the productive capacity of the economy. Differences in labour market participation may influence growth independently of trade reforms, making it essential to control for workforce dynamics.

Population Growth (annual %)

Population growth is included as a demographic driver of economic expansion. Rapid population growth may stimulate market size and labour supply but may also place pressure on resources. Its strong significance in your empirical results aligns with standard growth literature.

Institutional Quality (composite WGI index)

Institutional quality reflects governance effectiveness, regulatory standards, and rule of law. Decades of empirical evidence show that institutions shape how economies respond to trade reforms (Rodrik, 2008).
Including this variable ensures the tariff coefficient captures trade policy effects, not broader institutional weaknesses or strengths.

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4.5 Data Sources and Reliability

All variables were sourced from high-credibility international datasets:

- World Bank WDI → GDP growth, inflation, FDI, capital formation, labour force, population
- Ministry of Investment and International Trade of Uzbekistan → Tariff rates
- Worldwide Governance Indicators (WGI) → Institutional quality
- National statistics and IMF databases (for cross-checking missing values)

These sources ensure comparability across countries and years, minimise measurement error, and in accuracy with the data used in major empirical trade and growth studies. This careful selection provides a robust empirical foundation for isolating the effect of tariff policy on economic growth.

Summary Statistics (Central Asia, 1996 2024)

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP_Growth	145	5.89	4.17	-16.7	16.5
Tariff_Rate	145	5.17	3.32	0.0	18.0
Trade_Openness	145	82.82	32.61	29.19	181.59
FDI_Inflows	145	4.45	4.0	-4.85	22.52
Inflation	145	19.25	50.58	0.39	446.0
Gross_Capital_Formation	145	29.06	9.87	9.14	51.93
Labor_Force	145	62.28	12.54	41.97	80.33
Population_Growth	145	1.58	0.77	-2.5	2.56
Institutional_Index	145	-1.0	0.33	-1.6	-0.3

5.Results and Interpretations.

5.1. Results for R-squared

Table 1.

Model R-Squared

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Pooled OLS (Tariff only)	0.1764
Pooled + UZB dummy	0.1764
Pooled Interaction model	0.1952
FE (only tariff)	0.1551 (within)
FE (full controls)	0.4448 (within)
DK FE (full controls)	0.4448 (within)
DK FE Log(1+Tariff)	0.5224 (within)

The pooled OLS models explain about 18 20% of the variation in GDP growth, indicating a modest fit typical for macro-panel data. When country fixed effects and controls are added, the within R-squared increases to 0.445, which means nearly 45% of the growth variation within countries over time is explained by tariffs and the macroeconomic variables. The log-transformed Driscoll Kraay model represents better results, with a within R-squared of 0.522, suggesting that proportional changes in tariffs explain growth dynamics more effectively than absolute changes. Overall, model fit improves substantially when controlling for country heterogeneity and using a non-linear tariff specification.

4.2 Pooled OLS

Table 2: Pooled OLS Results

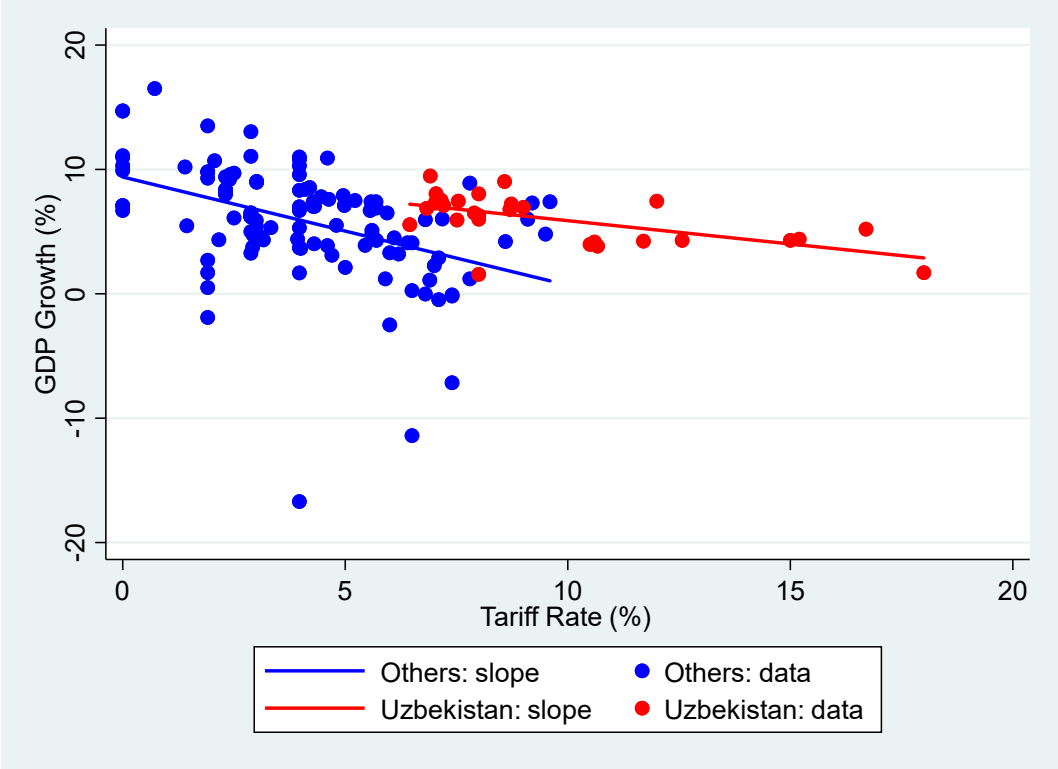
Variable	(1) Pooled OLS	(2) Pooled + UZB Dummy	(3) Interaction Model
Tariff Rate	-0.709*** (0.127)	-0.709*** (0.127)	-0.870*** (0.178)
Uzbekistan Dummy		4.101*** (0.877)	0.229 (1.141)
Tariff × Uzbekistan			0.495** (0.194)
Constant	8.740*** (0.606)	8.740*** (0.606)	9.392*** (0.763)

Across all pooled OLS specifications, tariff rates show a strong and statistically significant negative effect on GDP growth. A 1 % increase in tariffs reduces growth by 0.71 %, and this result remains unchanged, even after including the Uzbekistan dummy. The Uzbekistan dummy is positive and highly significant, indicating that Uzbekistan has, on average, around 4 percentage points higher

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annual growth than the regional baseline, also indicated in the Graph (Graph 1). Moreover, in the interaction model, the interaction term is positive and significant, showing that tariffs are less harmful in Uzbekistan compared to the other countries in Central Asia. However, the main tariff coefficient remains strongly negative, confirming that tariff increases generally reduce growth. Overall, the pooled OLS results suggest that higher tariffs slow economic growth in Central Asia, while Uzbekistan exhibits both higher baseline growth and a weaker negative tariff effect relative to its neighbours. This aligns with literature emphasising transitional dynamics and reform sequencing (Rodrik, 2008; Topalova, 2010). It also supports the hypothesis that partial liberalisation and policy insulation can temporarily dampen the negative effects of trade barriers.

Graph 1



4.2 Fixed Effects (clustered)

The fixed-effects results show that tariffs continue to have a negative and statistically significant effect on GDP growth, with a 1-percentage-point increase in tariff rates reducing growth by around 0.71 percentage points. Among the control variables, FDI inflows and population growth are positive and significant, indicating that inward investment and demographic expansion support economic growth. Inflation remains negative, consistent with macroeconomic instability reducing growth. Institutional quality has a negative coefficient, weakly significant, suggesting that periods of lower institutional performance may coincide with weaker growth within countries over time. Other controls (trade openness, capital formation, labour force participation) are not statistically significant in this

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http://houghtonstreetreview.com/index.php/hsr

specification. Overall, the fixed-effects model highlights tariffs, inflation, FDI, and population dynamics as the main drivers of within-country growth variation in Central Asia.

Table 2: Fixed-Effects (Clustered SE)

Variable	FE (Cluster SE)
Tariff Rate	-0.713* (0.300)
Trade Openness	0.027 (0.016)
FDI (% GDP)	0.086* (0.039)
Inflation	-0.039 (0.025)
Gross Capital Formation	0.005 (0.050)
Labour Force Participation	0.186 (0.252)
Population Growth	2.422*** (0.598)
Institutional Quality	-4.610* (2.538)
Constant	-11.160 (15.288)

4.3 Driscoll-Kraay FE

The Driscoll Kraay estimates confirm a strong and highly significant negative effect of tariffs on GDP growth, with the coefficient (−0.96) larger in magnitude than in the fixed-effects model, indicating that correcting for serial correlation and cross-sectional dependence strengthens the observed relationship(Table 3). The log-transformed model shows an even stronger effect: a 1% increase in tariffs (in proportional terms) reduces growth by around 5.5 percentage points, suggesting a non-linear and intensified impact of tariff increases on growth.

Across both specifications, trade openness remains positive and significant, while inflation consistently exerts a large and highly significant negative effect. Population growth continues to be strongly positive, and institutional quality remains weakly negative but significant at the 10% level. Other controls (FDI and capital formation) remain statistically insignificant.

Overall, the Driscoll Kraay and log-tariff models reinforce the robustness of the main finding: tariffs are consistently and substantially growth-reducing in Central Asia, with the effect becoming even more pronounced when modelled proportionally.

Table 3: Driscoll-Kraay & Log Model

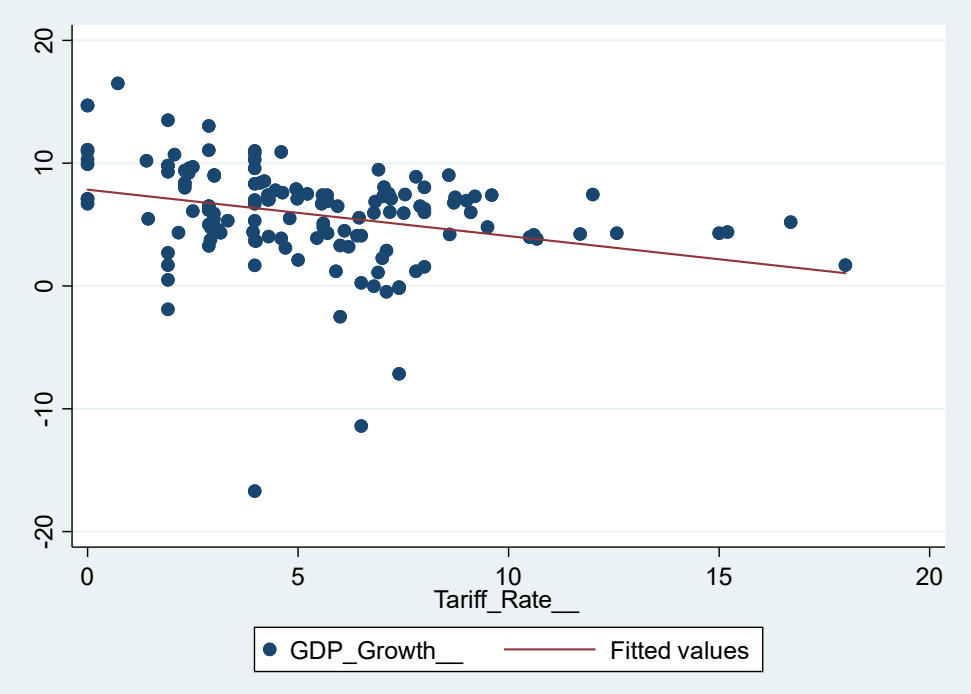
Variable	Driscoll-Kraay FE	Log FE DK
Tariff Rate	-0.962*** (0.142)	

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Log(1+Tariff)		-5.509*** (0.848)
Trade Openness	0.027** (0.011)	0.023** (0.010)
FDI (% GDP)	0.086 (0.100)	0.086 (0.087)
Inflation	-0.039*** (0.002)	-0.040*** (0.002)
Gross Capital Formation	0.005 (0.039)	-0.032 (0.032)
Population Growth	2.422*** (0.566)	2.506*** (0.551)
Institutional Quality	-4.610* (2.502)	-4.108* (2.157)
Constant	-11.160 (7.936)	6.412* (3.428)

To sum up all findings, pooled, fixed-effects, Driscoll Kraay, and log-transformed models reveal that tariffs consistently and significantly reduce GDP growth in Central Asia, while Uzbekistan grows faster and is less negatively affected (Graph 2). Also, these econometric results align closely with the established literature showing that tariff reductions foster economic growth. Consistent with studies such as Estevadeordal and Taylor (2013) and Amiti and Konings (2007), pooled OLS, fixed-effects, and Driscoll Kraay estimates all reveal a robust and economically meaningful negative relationship between tariff rates and growth.

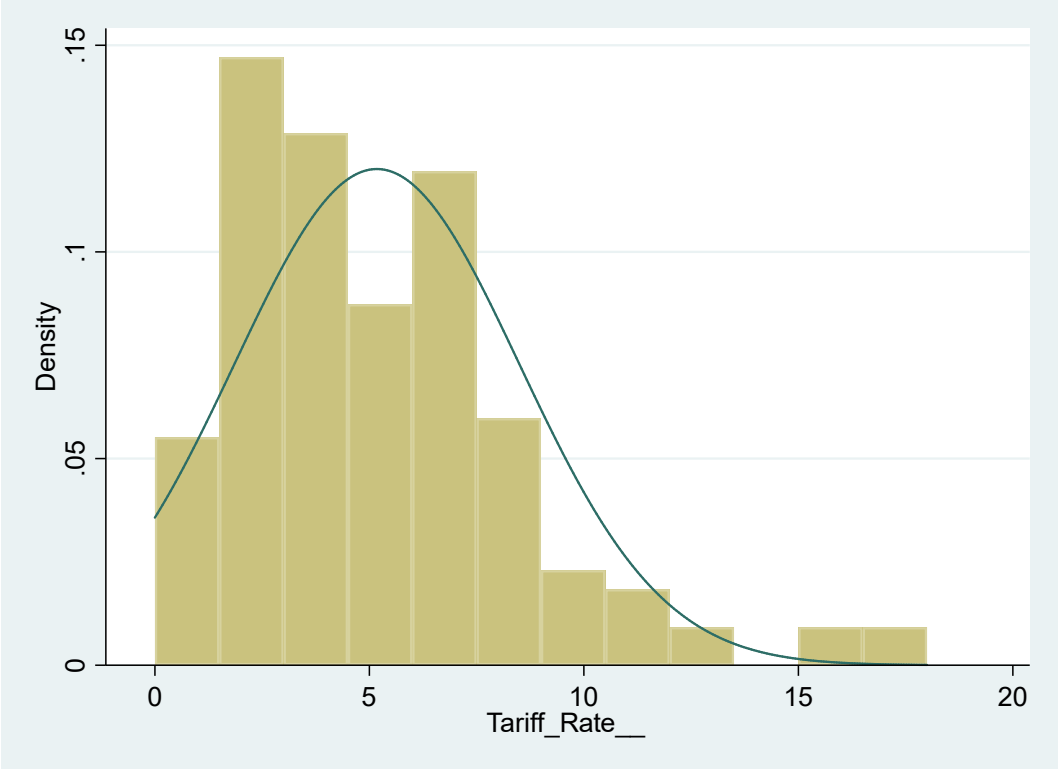
Graph 2



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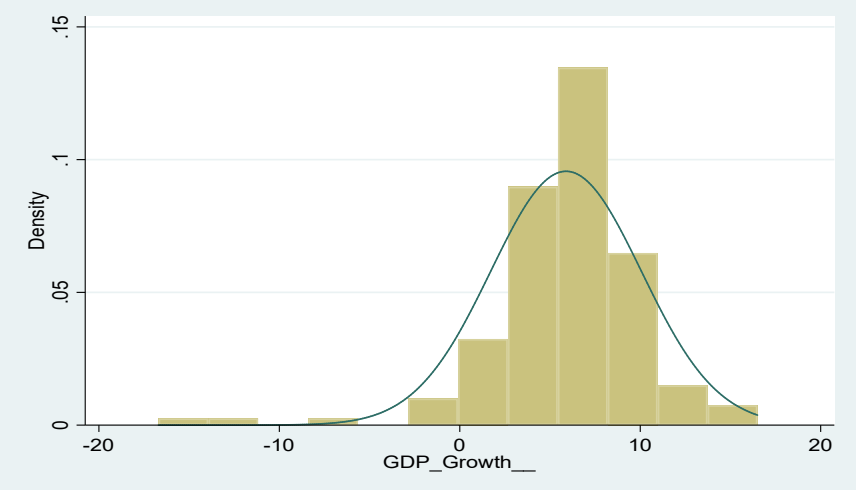
Econometric tests

Graph 3



The skewness kurtosis normality test indicates that tariff rates are significantly right-skewed ($p < 0.01$), which is typical for trade policy data. To address non-linearity and skewness, a log (1 + tariff) transformation was employed as an additional robustness check. The results remain qualitatively similar, confirming that higher tariffs are associated with lower economic growth in Central Asia.

Graph 4



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Normality tests indicate that GDP growth data deviate from a normal distribution ($p < 0.01$), reflecting real-world macroeconomic volatility. Since fixed-effects estimation with robust and Driscoll Kraay standard errors does not require normality of errors, this does not affect inference. The key concern is consistency and robustness, which are ensured.

6. Policy Recommendations

The empirical analysis reveal that tariff reductions significantly support GDP growth in Central Asian economies. With accordance to these results, the number of targeted policy actions are proposed. Initially, tariffs should be reduced gradually by the governments, as higher tariff rates significantly impede growth in all models.

The empirical findings indicate that tariff reductions consistently support higher economic growth across Central Asia. Based on these results, several targeted policy actions are proposed. A phased approach will ease adjustment pressures while improving competitiveness and lowering input costs. Tariff reforms should be complemented by stronger trade facilitation, including customs modernization, reduced non-tariff barriers, and improved logistics. These measures support to gain from trade openness. Moreover, the positive impact of FDI demonstrates the significance of attracting high-value foreign investment through transparent regulation, stable policy actions, and improved infrastructure. Because of FDI adjustment cost can be obtained and productivity can be improved. In addition, the institutional quality also plays a significant role, therefore, governance reforms, particularly in democracy, transparency, and efficient regulation are essential to achieve a sustainable growth from the reduction in tariff rates. However, the moderated tariff effect found for Uzbekistan highlights the effectiveness of its liberalisation strategy, which other Central Asian economies may consider replicating to achieve stable reform outcomes. Overall, the results support a reform approach that combines tariff reduction, institutional strengthening, trade facilitation, and investment promotion as mutually reinforcing elements of a long-term growth strategy.

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