Transport and Logistics Economics in The Context of The Caucasus and Türkiye: The Economic Effects of Infrastructure, Service Quality, and Regional Integration

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Abstract. Transportation and logistics networks have a significant role in the improvement trajectories of developing and transition economies. These are particularly supported by growing processes and regional integration factors. Logistics performance has increasingly become related to economic decision-making across short, medium, and long-term horizons. This is beyond typical growth determinants like capital accumulation and labour input. This article will demonstrate how logistics parameters relate to regional and national integration, income growth, with an emphasis on Armenia, Azerbaijan, Georgia, and Türkiye, over the 2010–2024 period. The empirical evidence supports the dominant role of capital accumulation while suggesting that the logistics integrated variables do not exhibit a consistent short-term effect. Instead of short-term growth factors, results support an interpretation of logistics performance as a structural facilitator of improvement. These outcomes state the presence of adjustment costs and delayed transmission mechanisms related to logistic investment. Accordingly, logistics activities that appear neutral in the short term may generate cumulative economic benefits over extended periods. The study adopts a hybrid methodological approach that combines quantitative panel estimations with qualitative interpretation. Finally, the analysis highlights the limitations of existing perception-based logistics indicators in capturing short-term effects, while specifying their relevance as long run horizon decision support tools for policy makers pursuing logistics-oriented development strategies.

Keywords: Logistics, Economic Growth, Transport, Geoeconomics, Green Corridors

1. Introduction

The region has long been characterized as a bridge that offers access to core markets; this description is still analytically lacking. From a geoeconomic perspective, the region operates less as a passive transit space and more as an integrated logistics environment in which production, distribution, and consumption networks intersect. (Günay et al., 2025). Within this context, logistics performance—shaped by the quality of transport infrastructure and logistics services—assumes importance alongside traditional production factors such as capital accumulation and labour input. Its contribution is not typically observed through short-term cyclical movements, but rather through gradual and cumulative

influences on long-term growth dynamics. (Yang et al., 2022). Through renovation, modernisation, and the integration of breakthrough technologies, logistics systems reduce operational costs, enhance market accessibility, and support the spatial diffusion of commercial activities (Li & Zhang, 2024; Alvarez-Palau et al., 2025). Viewing the Caucasus primarily as a corridor or transit route has delayed the recognition of logistics performance as a driver of development and, in turn, has also moderated the pace of economic growth (Gafarlı, 2025; Sharma & Dehalwar, 2025). Much of the existing literature approaches the Caucasus primarily through a transit-oriented lens, with an emphasis on corridor governance and institutional arrangements. As a result, the role of logistics performance itself—particularly as a determinant of long-term regional development—has received comparatively limited attention. Moreover, empirical contributions in this area often rely on cross-sectional data or short observation windows, restricting their ability to capture delayed or cumulative effects. (Harutyunyan, 2022), (Karchava et al., 2025), (Taisarinova, Loprencipe, & Junussova, 2020), (Chedia, 2024), (Hashimov, 2025). This study examines the impact of logistics performance on long-term and sustainable regional development, considering these restrictions. It accomplishes this by analysing a combination of logistics metrics, which encompass service quality, institutional efficiency, and operational effectiveness (Li, Radke, & Steimle, 2025), (Katamadze & Katamadze, 2023), (Prause, 2024). Within this framework, the study empirically examines whether logistics integration and improvements in logistics performance among Armenia, Azerbaijan, Georgia, and Türkiye exert an independent and statistically significant effect on regional economic growth (Deng & Noorliza, 2023), (Ukleba & Tsikhelashvili, 2021), (Abuselidze, 2021), (Raimbekov et al., 2018), (Brauweiler et al., 2023). The empirical analysis focuses on the relationship between logistics performance and income growth while explicitly accounting for capital accumulation and labour inputs. In addition, the study explores how logistics-related capabilities - such as transport mode optimisation, service quality improvements, and digitalization - are associated with regional logistics integration and broader economic performance. An extended production-function framework and panel data spanning the years 2010–2024 are used to analyze these problems. It is feasible to differentiate between short-term modifications and longer-term structural effects across different panel specifications by incorporating logistics performance into the growth model. The analysis is conducted within an extended production-function framework using panel data covering the period 2010-2024. This structure allows short-run adjustments and longer-term dynamics to be examined within a unified empirical setting. The following sections present the data construction procedures, empirical results, and their interpretation, before turning to policy implications and avenues for future research.

2. Theoretical Framework

2.1 Transport–Logistics and Economic Growth

In macroeconomic literature, classical factors such as capital, labour and technology are among the determinants of economic growth. However, transport and logistics infrastructure and service quality

can also contribute to growth by interacting with these three elements. For example, various studies have shown positive relationships between logistics performance indices (Logistics Performance Index – LPI) and economic growth. For example, a study on the links between logistics performance and economic growth indicated that logistics performance makes a significant contribution to growth. (Journal of Social Sciences, 2025). At the country level, the effectiveness of logistics systems is commonly assessed using a limited set of internationally recognised composite indicators. Among these, the most frequently cited measures include the World Bank's Logistics Performance Index (LPI), the Agility Emerging Markets Logistics Index developed by Agility Logistics (Transport Intelligence, 2018), and the infrastructure-related "basic requirements" component of the Global Competitiveness Index published by the World Economic Forum (Schwab & Sala-i-Martín, 2017). In the present study, empirical analysis is based exclusively on the LPI dataset.

2.2 Infrastructure and Service Quality

Transport infrastructure (roads, railways, ports, air transport) forms the physical basis of the logistics system, while service quality (the competence of logistics companies, tracking and tracing systems, customs processes, the efficiency of border crossings) is a key factor determining the performance of the logistics system. For example, the report entitled 'Drivers of Logistics Performance' prepared by the International Transport Forum on Türkiye has revealed that service quality strongly influences logistics performance. (OECD, 2015)

2.3 Transit Corridors, Regional Integration and Logistics

Regional corridors (e.g. East-West, North-South axes) can increase trade by reducing logistics costs and transit times. The effective use of transport between modes plays an important role in reducing these transit times. This is stated as intermodal transport. In road-rail or sea-rail intermodal transport, transport documents are drawn up regarding the sharing of responsibility. (Salar A, 2017).. The effectiveness of these corridors is particularly important for the regional economy in geographically strategic areas. For example, concepts such as the 'Trans-Caucasus Transit Corridor' are mentioned in the literature in relation to the Caucasus. (World Bank, 2020)

2.4 Literature Specific to Türkiye and the Caucasus

It is stated that Türkiye's logistics sector has growth potential in terms of its strategic location, infrastructure investments, and service quality. For example, a study conducted on Türkiye indicates that the country's logistics and transportation sector is worth USD 100 billion and accounts for a significant share of GDP (V. International Caucasus-Central Asia Foreign Trade and Logistics Congress, 2019). (Worldbank,2019) There is a stable growth in Turkiye's transportation and logistics sector. Especially in the Caucasus, the literature indicates that Azerbaijan is developing its transport and logistics infrastructure, increasing its ongoing transit volumes, and struggling to transform its strategic location into a logistics hub.

3. Data Construction, Variable Transformation and Empirical Methodology

3.1 Panel Structure and Data Sources

The empirical investigation is conducted using an unbalanced annual panel at the country level, comprising Türkiye, Azerbaijan, Georgia, and Armenia for the 2010–2024 period. Standard macroeconomic indicators are obtained from the World Bank's World Development Indicators database, whereas logistics performance is captured through the Logistics Performance Index. Given the periodic availability of composite logistics measures and the inclusion of lagged explanatory variables, the usable sample is reduced to 60 country–year observations. The dataset is organised in a country–year format, allowing all variables to be treated within a common panel structure. This specification makes it possible to estimate growth-related models that incorporate country-specific fixed effects, thereby accounting for unobserved heterogeneity across economies while retaining the time-series variation necessary to examine the dynamic contribution of logistics performance to economic growth.

3.2 Construction of the Dependent Variable: Real GDP per Capita

Real GDP per capita, measured in constant 2015 U.S. dollars, is employed as the dependent variable to capture income dynamics in a manner that is comparable across countries and over time. In order to stabilize variance, improve functional linearity, and allow coefficient estimates to be interpreted in elasticity terms, the variable is transformed into its natural logarithmic form. Descriptive statistics for logged real GDP per capita, reported in Table 1, reveal pronounced cross-country dispersion alongside relatively moderate within-country variation over the sample period, underscoring the relevance of accounting for both structural heterogeneity and intertemporal dynamics in the empirical specification.

Table 1. Descriptive Statistics of Main Variables (2010–2024)

Variable	Observations	Mean	Std. Dev.	Min	Max
ln(GDP per capita)	60	8.6510	0.4603	7.9360	9.6256
ln(GFCF, constant)	60	23.3285	1.8069	21.3279	26.7399
ln(Labor)	56	15.3377	1.2137	14.1966	17.4013
ln(LPI)	24	1.0056	0.1375	0.7930	1.2556

Table 1 summarises the descriptive statistics of the variables used in the empirical analysis over the 2010–2024 period. Logged GDP per capita exhibits an average value of 8.65, accompanied by a standard deviation of 0.46, suggesting a relatively limited degree of dispersion within the sample. While variation across countries is evident, the range between minimum and maximum values reflects a broadly steady upward movement in income levels over time rather than abrupt fluctuations. All reported statistics are calculated by the author using the compiled dataset. (World Bank, 2020; World Bank, 2023; World Bank, 2024).

3.3 Capital Variable and Inflation Adjustment

Physical capital accumulation is proxied by gross fixed capital formation (GFCF). For Türkiye, Georgia, and Armenia, GFCF series are reported in constant prices, which permits direct comparison both over time and across countries. By contrast, Azerbaijan's GFCF data are available only in nominal terms. If used without adjustment, this would introduce price-level effects and distort cross-country comparisons within the panel. To ensure consistency, Azerbaijan's nominal GFCF series is therefore converted into real terms using the GDP deflator obtained from the World Bank's World Development Indicators (WDI). Accordingly, the real capital series is constructed as follows:

$$\mathrm{GFCF}_{it}^{const} = \frac{\mathrm{GFCF}_{it}^{current}}{\mathrm{GDP\ Deflator}_{it}/100} \tag{1}$$

Following deflation, the capital series is expressed in natural logarithms in order to maintain consistency of scale with the remaining production inputs and to allow coefficients to be interpreted as elasticities.

Evidence reported in Table 2, which contrasts nominal and deflated capital measures, illustrates the extent to which price movements—especially during periods of elevated inflation—distort the unadjusted series. Accounting for these effects is empirically important. When nominal capital values are used in preliminary estimations, the resulting coefficients exhibit clear instability and an upward bias, specifying that inflationary pressures rather than actual capital accumulation drive a substantial part of the estimated effect.

Table 2. Capital Stock Correction via GDP Deflator (Azerbaijan)

Year	**GFCF (Current Prices)**	**GDP Deflator**	**Real GFCF (2015=100)**
2010	nominal	158.59	deflated
2015	nominal	183.62	deflated
2020	nominal	253.32	deflated
2024	nominal	377.99	deflated

3.4 Labor Input

Labour input is represented by the total size of the labour force, using data obtained from the World Bank's World Development Indicators (SL.TLF.TOTL.IN). The series is aligned with the country–year panel structure and expressed in natural logarithms to remain consistent with the underlying production-function framework. As shown by the descriptive statistics in Table 1, labour force measures display considerably smoother dynamics than those observed for capital accumulation and income. This pattern points to limited short-run variability and suggests that labour input in the model essentially reflects longer-term demographic developments and labour market participation trends over the sample period.

3.5 Annualization of the Logistics Performance Index

The Logistics Performance Index (LPI), published by the World Bank, is available at irregular intervals (2010, 2012, 2014, 2016, 2018, and 2023), whereas the empirical strategy requires annual

observations for panel data estimation. To reconcile this temporal mismatch, an explicit annualization procedure is implemented. Observed LPI scores are first structured in wide format and subsequently reorganized into a country–year panel. Missing annual values are then constructed through linear interpolation between adjacent benchmark observations, thereby generating a continuous annual series that preserves the underlying medium-term trend in logistics performance while avoiding the imposition of short-run volatility not supported by the data.

$$LPI_{i,t+k} = LPI_{i,t} + \frac{k}{T}\left(LPI_{i,t+T} - LPI_{i,t}\right) \tag{2}$$

Here, T represents the interval between two consecutively reported LPI benchmark observations. For boundary years at the beginning and end of the sample, forward- and backward-propagation procedures are employed to complete the annual series. The resulting country-specific logistics performance trajectories are subsequently transformed into natural logarithmic form to ensure consistency with the production-function specification and to facilitate elasticity-based interpretation. Interpolated LPI paths for each country are illustrated in Figure 1, while descriptive statistics reported in Table 3 document changes in the distributional properties of the series before and after annualization. The interpolation procedure increases within-country temporal variation relative to the original benchmark-only series, thereby strengthening parameter identification in fixed-effects regression frameworks. At the same time, Figure 1 underline pronounced cross-country heterogeneity in logistics performance dynamics: Türkiye exhibits higher average levels accompanied by greater intertemporal volatility, whereas Georgia displays a comparatively stable logistics trajectory over the sample period.

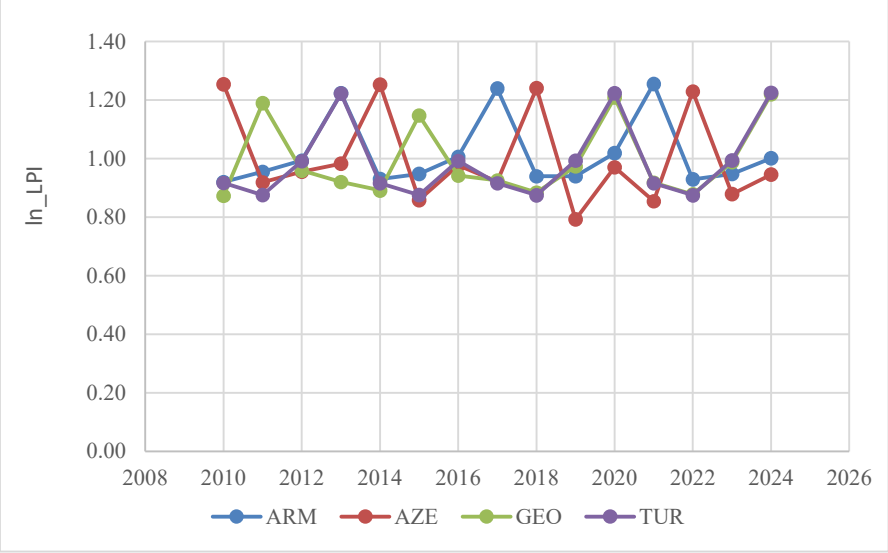

Figure 1. Interpolated ln (Logistics Performance Index) by Country, 2010–2024 (Compiled by author)
Notes: Annual values are obtained via linear interpolation between World Bank benchmark LPI survey years. The figure displays the natural logarithm of the interpolated series.

Table 3 confirms that annualization increases within-country temporal coverage without altering relative logistics performance rankings.

Table 3. LPI Coverage Before and After Annualization

Country	Observed LPI Years	Annualized Years	Mean ln (LPI)
Armenia	6	15	0.94
Azerbaijan	6	15	0.96
Georgia	6	15	0.95
Türkiye	6	15	1.22

3.6 Baseline Econometric Specification

Economic growth was modeled using an extended Cobb–Douglas production framework:

$$\ln(Y_{it}) = \beta_0 + \beta_1 \ln(K_{it}) + \beta_2 \ln(L_{it}) + \beta_3 \ln(Lg_{it}) + \mu_i + \varepsilon_{it} \quad (3)$$

Country fixed effects (μ_i) were incorporated to control for unobserved, time-invariant heterogeneity. Table-4 presents baseline pooled OLS and country fixed-effects estimates, demonstrating that failure to control for country heterogeneity leads to biased and unstable coefficient estimates.

Table 4. LPI Coverage Before and After Annualization

Variable	Pooled OLS	Country FE
ln(GFCF_const)	**0.296***	**0.340***
ln(Labor)	- 0.063	0.554
ln(LPI)	- 0.219	**- 0.860**
Constant	2.934	- 6.213
Country fixed effects	No	Yes
Observations	60	60

Note: * *** p<0.01, ** p<0.05

Interpretation of notations regarding significance factors are depicted in Table 5.

Table 5. Notation and Interpretation Table

Notation	Significance Level	Interpretation
***	p < 0.01	Strong statistical evidence at the 1% significance level
**	p < 0.05	Statistically significant at the 5% significance level
*	p < 0.10	Weak statistical significance at the 10% level
-	p ≥ 0.10	Not statistically significant

As reported in Table 4, capital accumulation exhibits a positive and statistically significant elasticity across both pooled and fixed-effects specifications, while logistics performance enters with a negative coefficient once country heterogeneity is controlled for. (Compiled by author)

3.7 Lagged Logistics Performance and Adjustment Dynamics

Given the investment-intensive nature of logistics reforms, contemporaneous effects were not presumed. Accordingly, logistics performance was introduced with a one-period lag:

$$\ln(Y_{it}) = \beta_1 \ln(K_{it}) + \beta_2 \ln(L_{it}) + \beta_3 \ln(Lg_{i,t-1}) + \mu_i + \varepsilon_{it} \quad (4)$$

A statistically significant negative coefficient on lagged logistics performance is shown by the estimation results, which are presented in Table 6. This finding implies that short-term productivity

gains may be outweighed by initial adjustment costs and fiscal pressures resulting from improvements in logistics infrastructure and procedures.

Table 6. Fixed Effects Model with Lagged Logistics Performance

Variable	FE + ln(LPI_{t-1})
ln(GFCF_const)	**0.349***
ln(Labor)	**0.668**
ln(LPI_{t-1})	**- 1.280***
Constant	- 7.644
Country fixed effects	Yes
Observations	56
Adjusted R^2	**0.94**

3.8 Two-Way Fixed Effects and Common Shocks

To isolate logistics-specific effects from global and regional shocks, year fixed effects were added to the model:

$$\ln(Y_{it}) = \beta_1 \ln(K_{it}) + \beta_2 \ln(L_{it}) + \beta_3 \ln(Lg_{i,t-1}) + \mu_i + \lambda_t + \varepsilon_{it} \quad (5)$$

When time effects are taken into account, the logistics coefficient loses statistical significance, according to the corresponding results, which are compiled in Table 7. This outcome suggests that a non-trivial portion of the observed variation in logistics performance is associated with common time-specific shocks—such as global economic downturns and geopolitical disruptions—rather than solely with country-specific structural factors.

Table 7. Two-Way Fixed Effects Results (Country and Year)

Variable	Two-Way FE
ln(GFCF_const)	**0.248***
ln(Labor)	- 0.215
ln(LPI_{t-1})	0.236
Country FE	Yes
Year FE	Yes
Observations	56
Adjusted R^2	**0.99**

Note: * *** p<0.01, Dependant variable: ln(GDP per capita)

The ln(GFCF_const) variable is found to be statistically significant at the 1% level with a positive coefficient *(b =0.248)* . This finding indicates that increases in capital investment are linked to statistically significant increases in the per capita income levels of nations. Given the logarithmic specification of the model, a 1% increase in capital accumulation is interpreted as being associated with an approximate 0.25% increase in per capita income. In contrast, although the labour variable (ln(Labour)) has a negative coefficient, it is not statistically significant. This indicates that, when controlling for country and year fixed effects, an increase in labour does not have a reliable effect on income levels. The absorption of unobservable factors such as demographic structure and labour force

quality by fixed effects may have contributed to this result. The lagged value of the logistics performance index ($\ln(LPI_{t-1})$) also has a positive coefficient but is not statistically significant. Although this finding implies that improvements in logistics performance could potentially contribute to economic growth, it shows that when country-specific, time-invariant structural characteristics (such as geographical advantages, infrastructure legacy, and institutional structure) are controlled for, the effect of the LPI variable cannot be clearly distinguished. The adjusted R^2 value of the model, being 0.99 is characteristic of two-way fixed effects models, as the country and year dummies explain a very large portion of the variation in the data set. Therefore, the interpretation of the coefficients is based on 'changes over time within countries. Overall, the findings indicate that capital accumulation is a meaningful and strong determinant of economic growth, while labour and logistics performance variables do not showa significant effect when fixed effects are controlled.

3.9 Growth-Oriented Specification: First Differences

First difference specification was estimated in order to distinguish level effects from growth dynamics:

$$\Delta \ln (Y_{it}) = \gamma_1 \Delta \ln (K_{it}) + \gamma_2 \Delta \ln (L_{it}) + \gamma_3 \Delta \ln (Lg_{it}) + u_{it} \quad (5)$$

Growth regression results are reported in Table 8. Results in Table-8 indicate that improvements in logistics performance are positively associated with growth rates, although the effect remains statistically weak in the short run.

Table 8. Growth Regression (First Differences)

Variable	**Δln Model**
Δln (GFCF_const)	**0.102***
Δln (Labor)	0.285
Δln (LPI)	0.231
Constant	0.032
Observations	52
R^2	**0.26**

Note: * *** p<0.01, Dependent variable: Δln(GDP per capita)

Capital growth remained positive and statistically significant, while changes in logistics performance entered with a positive but statistically weak coefficient. Figure 2 plots average logistics improvements against growth rates, visually reinforcing the absence of a strong short-run relationship.

Figure 2 displays the short-run association between year-to-year changes in logistics performance and economic growth. The scatter plot reveals a highly dispersed distribution of observations around zero, with no visible linear structure. The fitted regression line displays a slightly positive slope ($\beta \approx 0.223$), but its explanatory power is almost negligible ($R^2 = 0.0021$). It is therefore defined that annual enhancements in logistics performance are not associated with immediate growth responses. Rather, the economic impact of logistics performance is more plausibly transmitted through longer-term structural adjustments—such as improvements in corridor efficiency, the implementation

of customs reforms, and the strengthening of multimodal connectivity—than through short-run variations captured by first-differenced specifications.

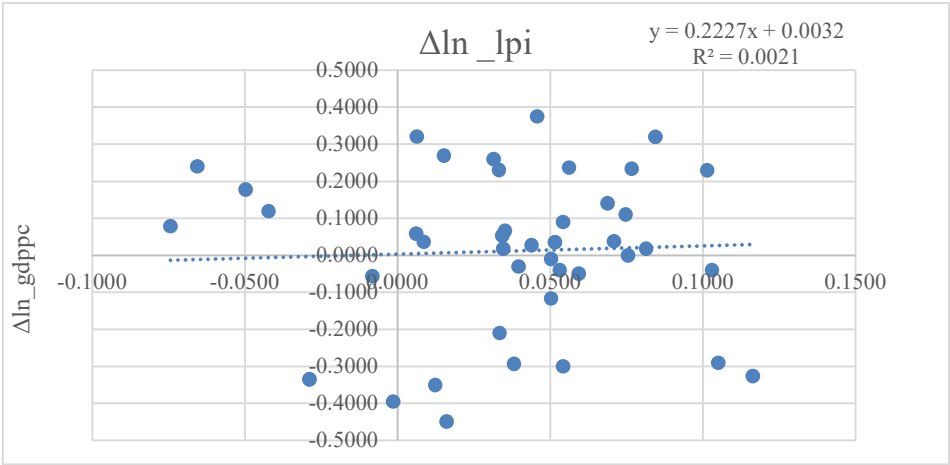

Figure 2. Short-run relationship between Δln(Logistics Performance Index) and Δln(GDP per capita)

4. Synthesis of Empirical Findings

Across all model specifications, capital accumulation is consistently identified as the primary determinant of economic performance. The contribution of labor input is found to be limited and does not display robust statistical significance. By contrast, logistics performance is shown to exhibit a non-linear and specification-sensitive association with economic growth: negative effects are observed in level-based models, statistical insignificance emerges once time effects are incorporated, and positive yet quantitatively modest effects are detected in growth-rate regressions. Table 8 synthesizes all model specifications and corresponding coefficient estimates, underscoring the sensitivity of logistics-related findings to choices regarding data construction, temporal structure, and econometric specification.

5. Implications and Research Limits

The findings and results suggest that logistics performance should not be interpreted as an automatic or immediate driver of economic growth in transition economies. Rather, its outcomes appear to be conditional upon investment cycles, adjustment frictions, and broader macroeconomic circumstances. Notwithstanding extensive data transformation and rigorous model testing, certain limitations remain, primarily due to the perception-based character of the Logistics Performance Index and the limited cross-sectional scope of the sample. Future research may be enhanced through the use of disaggregated logistics indicators, the inclusion of broader regional samples, and the application of dynamic panel estimation techniques.

6. Findings and Results

The major findings indicate that logistics performance should not be interpreted as an automatic or immediate engine of economic growth in transition economies. Instead, its economic effects appear to be contingent upon investment cycles, adjustment frictions, and broader macroeconomic conditions. Despite extensive data transformation and rigorous model testing, certain limitations persist, primarily

reflecting the perception-based nature of the Logistics Performance Index and the limited cross-sectional dimension of the sample. Future research could be strengthened through the use of disaggregated logistics indicators, the expansion of regional coverage, and the application of dynamic panel estimation techniques. Once unobserved country-specific heterogeneity is controlled for through fixed-effects estimation, the coefficient associated with logistics performance becomes negative and statistically significant, pointing to the presence of short-run adjustment costs. These costs are likely to stem from infrastructure investment burdens, regulatory restructuring, and transitional inefficiencies accompanying logistics system upgrades. When time fixed effects are introduced, the statistical significance of logistics performance dissipates. This outcome suggests that logistics indicators are highly synchronized with common regional or global shocks—such as trade decelerations, geopolitical tensions, and pandemic-related disruptions—thereby constraining their independent explanatory power in contemporaneous regressions. Additional insight into the temporal structure of logistics effects is obtained by introducing a lagged logistics performance variable. The lagged specification yields a statistically significant negative coefficient, implying that initial improvements in logistics performance may impose short-term economic costs before productivity-enhancing benefits materialize. This pattern is consistent with adjustment-cost dynamics and learning-by-doing mechanisms widely discussed in the infrastructure and institutional reform literature. Finally, growth regressions based on first-differenced variables confirm the absence of a robust short-run relationship between logistics performance and income growth. Although the estimated coefficient on changes in logistics performance is positive, it remains statistically weak and explains virtually none of the observed variation in growth rates. This conclusion is further supported by the graphical evidence presented in Figure 2, which reveals a highly dispersed association with negligible explanatory power. A summary of empirical findings across all model specifications is presented in Table 9.

Table 9. Summary of Empirical Findings Across Model Specifications

Model Specification	**ln(K)**	**ln(L)**	**ln(LPI) / Δln(LPI)**	**Interpretation of Results**
Pooled OLS				Uncontrolled correlations; reflects raw associations rather than causal effects
Fixed Effects (Country)				Evidence of short-run adjustment costs associated with logistics improvements
Two-Way Fixed Effects (Country + Year)				Common time shocks dominate; logistics effects are absorbed by year effects
Fixed Effects with Lagged LPI				Delayed negative impact consistent with investment and reform costs
Growth Model (First Differences)				Positive but statistically weak short-run association

7. Conclusion and Recommendations

The nature of the connection between logistics performance and economic growth in economies that are developing regions is the subject of this study. Capital accumulation, labour input, and logistics performance are considered within a holistic analytical framework. The central conclusion is that logistics performance should not be interpreted as a short-run trigger of economic growth, but rather as a structural facilitator whose economic effects accumulate gradually over time. Adjustment costs, institutional learning processes, and economic actor coordination are all intrinsic to investments in logistics infrastructure, regulatory frameworks, and service quality. As a result, the contribution of logistics performance to economic growth materializes not in the short term, but gradually over the long run. From a policy point of view, it is more convenient to view logistics reforms as long-term strategic investments that operate in conjunction with capital formation, institutional quality, and macroeconomic stability. In this context, strengthening logistics systems in transition economies does not produce immediate and pronounced effects on short-term growth indicators; instead, it plays a complementary role by supporting trade facilitation and the transformation of production structures.

The difficulty of obtaining meaningful and consistent results from short-run panel analyses based on perception-based logistics indicators also highlights the methodological boundaries of this study. Future research would benefit from the use of more disaggregated logistics measures, dynamic model specifications, and longer analytical horizons, which would allow the delayed and cumulative contribution of logistics to economic growth to be captured more effectively. Overall, this study contributes to the literature by emphasizing that logistics performance should be conceptualized not as an immediate catalyst for economic growth, but as a strategic enabler and accelerator, a long-term prerequisite for economic development.

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