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THE IMPACT OF LOGISTICS PERFORMANCE ON EXPORTS: EVIDENCE FROM POST-SOVIET COUNTRIES (2007–2023).

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Abstract

The present study investigates the impact of logistics system efficiency on export performance in post-Soviet economies. The utilization of panel data from 14 former Soviet republics spanning the period from 2007 to 2023 (excluding Turkmenistan due to missing data) facilitates the estimation of fixed-effects models. These models establish a correlation between exports and logistics performance (LPI), gross domestic product (GDP), the exchange rate, and foreign direct investment (FDI). Given the availability of observations for irregular calendar years, a lag is defined as the previous available observation to model logistics effects. The findings indicate that contemporaneous logistics performance is statistically insignificant, while lagged logistics performance is positive and significant. This suggests that improvements in logistics lead to higher exports, albeit with a delay. The relationship between GDP and FDI, as well as their role as positive determinants of exports, remains robust. The application of diagnostic tests reveals the presence of first-order autocorrelation and groupwise heteroskedasticity. Consequently, inference is contingent upon the utilization of country-clustered standard errors. The findings indicate that the implementation of ongoing logistics reforms and investments in trade facilitation can serve as effective medium-term catalysts for export growth in transition economies.

The following keywords should be used to index this document: logistics performance, exports, trade facilitation, panel data, fixed effects, post-Soviet countries. The following JEL codes are recommended for indexing this document as well, although they are not required: F14, F15, C23, and O24.

Introduction

In the contemporary global economy, logistics has become a core determinant of international competitiveness and export performance. The fragmentation of production across borders and the expansion of global value chains have fundamentally increased the importance of logistics systems in shaping countries participation in international trade. Despite the decline in tariff barriers, persistent

challenges persist, including transportation costs, time delays, customs procedures, documentation requirements, and supply-chain uncertainty, which continue to impede cross-border exchange (Arvis et al., 2018; World Bank, 2023). Contemporary trade theory and empirical research have accentuated the role of time as a trade barrier. Extended delivery times and unreliable logistics have been shown to diminish firms' capacity to compete in foreign markets, particularly in the domains of higher-value and time-sensitive goods (Hummels & Schaur, 2013; Korinek & Sourdin, 2011). The World Bank developed the LPI to benchmark logistics-related trade frictions. The LPI has become one of the most widely used global indicators of trade logistics quality. The LPI captures multiple dimensions of logistics systems, including customs efficiency, quality of trade and transport infrastructure, ease of arranging international shipments, competence of logistics services, tracking and tracing capability, and shipment timeliness (World Bank, 2023). The most recent LPI editions have expanded measurement approaches by integrating data from large shipment datasets. This integration reflects the growing relevance of speed, resilience, and reliability in global supply chains in the wake of recent global disruptions (Arvis et al., 2023). A substantial corpus of empirical literature documents a robust positive relationship between logistics performance and export outcomes. Cross-country studies consistently demonstrate that enhancements in logistics quality lead to a reduction in trade costs and a substantial increase in export volumes (Behar & Venables, 2011; Martí, Puertas & García, 2017). Research focusing on supply chains has demonstrated that logistics performance affects not only the scale of exports, but also firms' ability to integrate into global production networks and diversify toward higher-value products (Hausman, Lee & Subramanian, 2013; World Bank, 2020). These findings establish logistics not merely as a supporting service but as a productive, trade-enabling capability.

These global relationships are of particular importance for post-Soviet economies, many of which continue to face transition-related institutional constraints, uneven infrastructure modernization, and importantly geographic disadvantages. It is noteworthy that several of these countries are landlocked, placing them at a considerable disadvantage due to their reliance on cross-border transit corridors. This reliance invariably exposes them to elevated transportation costs, protracted delivery times, and heightened vulnerability to border inefficiencies (United Nations, 2022; Arvis et al., 2018). In such contexts, the effectiveness of exports is contingent not solely on domestic logistics reforms but also on the efficiency of transportation corridors, effective customs coordination, and the caliber of logistics services. Despite the gradual improvements observed,

logistics performance across post-Soviet countries exhibits significant heterogeneity. According to the World Bank (2023), the quality of logistics in the region continues to fall short of that observed in advanced trading economies. This is evidenced by persistent deficiencies in customs efficiency, multimodal connectivity, and service reliability. Despite the implementation of regional initiatives and infrastructure investments aimed at fortifying trade corridors connecting Europe and Asia, the export response to these logistics enhancements has exhibited disparities across nations (Pomfret, 2019; World Bank, 2023). Despite the extensive international literature linking logistics performance to trade, empirical evidence focusing specifically on post-Soviet economies as a regional group remains limited. A significant proportion of extant research relies on global cross-sectional samples, which may obscure region-specific institutional, geographic, and historical dynamics. Consequently, there is a necessity for a deliberate, panel-based analysis that investigates the impact of logistics performance on exports within the post-Soviet space over time.

In light of the aforementioned context, the present study undertakes an examination of the impact of logistics performance on exports. The following is an analysis of the available evidence from Post-Soviet Countries (2007–2023) using panel data covering 14 post-Soviet economies, as observed in the official LPI survey years. The study's primary objectives are threefold:

The objective of this study is to empirically assess whether improvements in logistics performance are associated with higher export performance in post-Soviet countries and examining whether the effect of logistics performance on exports is immediate or materializes with a lag, reflecting the gradual impact of infrastructure and institutional reforms. Besides, to evaluate the role of key macroeconomic controls—economic scale GDP, exchange rates, and foreign direct investment—in shaping export outcomes alongside logistics performance.

Methodologically, the study applies fixed-effects panel estimators to control for unobserved country-specific heterogeneity and employs robust clustered standard errors to address heteroskedasticity and serial correlation. Given that FDI inflows can be either zero or negative, the analysis employs the inverse hyperbolic sine transformation to ensure the preservation of observations while maintaining interpretability analogous to logarithmic specifications.

This research makes significant contributions to the existing body of knowledge in this field. First, it provides region-specific empirical evidence on the logistics–exports nexus within the post-Soviet space, a group of economies sharing historical legacies yet exhibiting substantial variation in logistics systems and trade integration. Secondly, the incorporation of lag structures and panel techniques

within the study illuminates the dynamic nature of logistics reforms, thereby offering insight into the translation of improvements into export performance over time.

From a policy perspective, the findings are directly relevant for governments and trade authorities seeking to enhance export competitiveness through logistics and trade facilitation reforms. The identification of the magnitude and timing of logistics effects can facilitate the prioritization of investments in customs modernization, corridor development, and logistics service quality. Given that export diversification and deeper global integration are central to sustainable growth strategies across post-Soviet economies, this study provides evidence-based guidance for designing logistics-centered development policies.

The Introduction is where the background, research problem, objectives, and significance of the study are presented. The Literature Review methodically examines extant studies on international labor migration and identifies research gaps. The methodology delineates the analytical framework, data sources, and research design employed. The subsequent section, titled "Findings and Discussion," undertakes an interpretive analysis of the results and engages in a discourse surrounding their implications. In conclusion, the major findings are summarized and recommendations are provided for future policy and research directions.

Literature Review

In recent decades, the nexus between logistics performance and export activity has garnered mounting scholarly attention. As global value chains have expanded and production processes have become geographically fragmented, logistics systems have evolved from a supportive function into a central determinant of trade competitiveness (Hausman, Lee & Subramanian, 2013; World Bank, 2020). Contemporary trade theory underscores the notion that logistics quality exerts a significant influence on various parameters within the realm of international trade. These include transportation costs, delivery reliability, coordination efficiency, and the capacity of firms to adhere to international standards. These factors collectively contribute to the determination of export potential (Hummels & Schaur, 2013; Arvis et al., 2018). Empirical studies consistently demonstrate a positive correlation between logistics performance and export volumes. Utilizing cross-country data, Behar and Venables (2011) demonstrate that enhancements in transport and logistics systems result in substantial increases in bilateral trade flows, with particularly robust effects observed in developing economies. In a similar vein, Martí, Puertas, and García (2017) conducted a comprehensive analysis encompassing over 100 countries, which yielded a notable finding: a one-point

increase in the Logistics Performance Index (LPI) was found to be associated with an average increase of 15–25 percent in exports. The findings of this study lend support to the argument that logistics efficiency has a direct impact on export competitiveness, achieved by reducing trade costs and enhancing market access. Research in this area has demonstrated the importance of logistics in shaping the structure and quality of exports, in addition to trade volumes. Hausman et al. (2013) demonstrate that nations with superior logistics systems exhibit a greater propensity to engage in complex supply chains and export products with a higher value-added component. Hoekman and Nicita's (2011) research aligns with this perspective, demonstrating that indicators of trade facilitation, such as logistics quality, exert a more pronounced influence on exports compared to tariff reductions. This mounting body of evidence establishes logistics performance as a productive factor influencing both the scale and sophistication of exports.

Subsequent studies have expanded the logistics–exports literature by examining specific channels through which logistics performance affects trade. As asserted by Korinek and Sourdin (2011) and Hummels and Schaur (2013), the temporal element is of paramount importance. Their research indicates that delays in shipping and border clearance have a substantial impact on export competitiveness, particularly for goods that are time-sensitive and of high value. Their findings underscore the notion that logistics performance encompasses not only the physical infrastructure but also the elements of speed, predictability, and coordination. Conversely, other scholars have directed their research toward the multidimensional nature of logistics systems. Arvis et al. (2018) posit that customs efficiency, service quality, and tracking capabilities are as important as transport infrastructure. Puertas, Martí, and García (2014) utilize disaggregated LPI components to ascertain that customs procedures and logistics service competence exert particularly robust effects on export flows. Similarly, Çelebi's (2019) study demonstrates that enhancements in tracking and tracing capabilities, as well as shipment timeliness, have a substantial impact on firms' integration into global markets.

Recent studies have identified a correlation between logistics performance and export diversification and resilience. As demonstrated by Shepherd and Wilson (2013), effective logistics systems are conducive to the establishment of new export markets and the diversification of products. In the aftermath of the Great Recession, Arvis et al. (2023) underscored the pivotal role of logistics resilience and reliability in facilitating trade recovery, underscoring the significance of logistics quality in sustaining export growth in the face of global uncertainty.

Methodologically, the extant literature employs a wide range of quantitative techniques to analyze the logistics–exports nexus. Preliminary research has largely relied on gravity models with cross-sectional data to assess the impact of logistics indicators on bilateral trade flows (Behar & Venables, 2011; Hoekman & Nicita, 2011). While these approaches are informative, they are limited in their ability to capture country-specific dynamics and temporal adjustments. Subsequent research has increasingly adopted panel data methods to control for unobserved heterogeneity and to analyze changes over time. Martí et al. (2017) and Gani (2017) utilize fixed- and random-effects models to examine how variations in logistics performance influence export outcomes across countries. Concurrently, alternative studies have been conducted that employ dynamic specifications, instrumental variable approaches, and system GMM estimators to address the endogeneity between trade and logistics development (Hausman et al., 2013; Portugal-Perez & Wilson, 2012). Contemporary contributions have incorporated lag structures and nonlinear transformations to capture delayed and asymmetric effects of logistics reforms. Arvis et al. (2018) posit that investments in logistics frequently exert a delayed impact on international trade. This is due to the time required for infrastructure development, institutional reforms, and the enhancement of service quality to yield export growth. This methodological evolution underscores the necessity for panel-based frameworks that allow for persistence, adjustment dynamics, and country-specific effects. Notwithstanding the existence of substantial global evidence, several significant gaps persist. Firstly, a significant proportion of extant literature is dominated by large cross-country samples, which may obscure regional and historical particularities. Secondly, empirical research focusing explicitly on post-Soviet economies as a coherent group is limited, even though these countries share common institutional legacies, transition-related constraints, and heterogeneous logistics performance trajectories (Pomfret, 2019; World Bank, 2023). Thirdly, although landlockedness and transit dependence are widely recognized as structural trade barriers (United Nations, 2022), few studies empirically examine how logistics performance affects exports within regions where these constraints are prevalent. Finally, the dynamic effects of logistics reforms—particularly whether improvements influence exports contemporaneously or with a lag—remain underexplored in the context of post-Soviet economies. This study addresses these gaps by providing a panel-based empirical assessment of the impact of logistics performance on exports in 14 post-Soviet countries over the period 2007–2023. The application of fixed-effects estimators, robust inference techniques, and lag structures enables the research to capture both cross-country heterogeneity and temporal dynamics. By doing so, it

contributes region-specific evidence to the logistics–trade literature and offers insights directly relevant for trade facilitation and logistics reform strategies in post-Soviet economies.

Methodology

The present study is grounded in classical and modern international trade theory, particularly the Theory of Comparative Advantage (Ricardo, 1817) and the New Trade and Trade Cost Theory (Anderson & van Wincoop, 2004). According to classical trade theory, countries stand to benefit from specialization according to relative efficiency, a phenomenon that has been demonstrated to result in increased trade volumes and enhanced welfare. In the contemporary global economy, however, the determination of comparative advantage no longer exclusively relies on production costs. Instead, it is also influenced by a country's capacity to efficiently facilitate the movement of goods across borders. According to contemporary trade theory, a multitude of factors, including transportation expenses, border delays, logistics inefficiencies, and institutional frictions, collectively exert a substantial influence on the patterns of international trade. High logistics costs function as implicit trade barriers, thereby reducing export competitiveness even in the presence of low tariffs. The implementation of efficient logistics systems has been demonstrated to result in a reduction in delivery time, an enhancement in reliability, and a decrease in transaction costs. Consequently, these systems have the potential to strengthen a nation's effective comparative advantage (Hausman et al., 2013; Martí et al., 2017). In the context of landlocked and transition economies, logistics performance assumes particular significance. Weak infrastructure, inefficient customs procedures, and limited multimodal connectivity have been identified as factors that disproportionately increase trade costs and constrain export potential. Accordingly, this study conceptualizes logistics performance as a modern determinant of comparative advantage, linking logistics efficiency directly to export performance.

According to the extant theoretical literature, the relationship between logistics and exports is explained through three primary mechanisms. Cost channel: The enhancement of logistics has been demonstrated to result in a reduction of transportation, handling, and administrative expenditures, thereby decreasing the final price of exported goods and enhancing international competitiveness. Time and reliability channel: The implementation of expedited customs clearance procedures, advanced tracking systems, and dependable transport networks has been demonstrated to reduce delivery uncertainty and delays. This is particularly salient for time-sensitive and high-value exports, for which such efficiencies are of paramount importance. Market-access channel: The integration of firms into global

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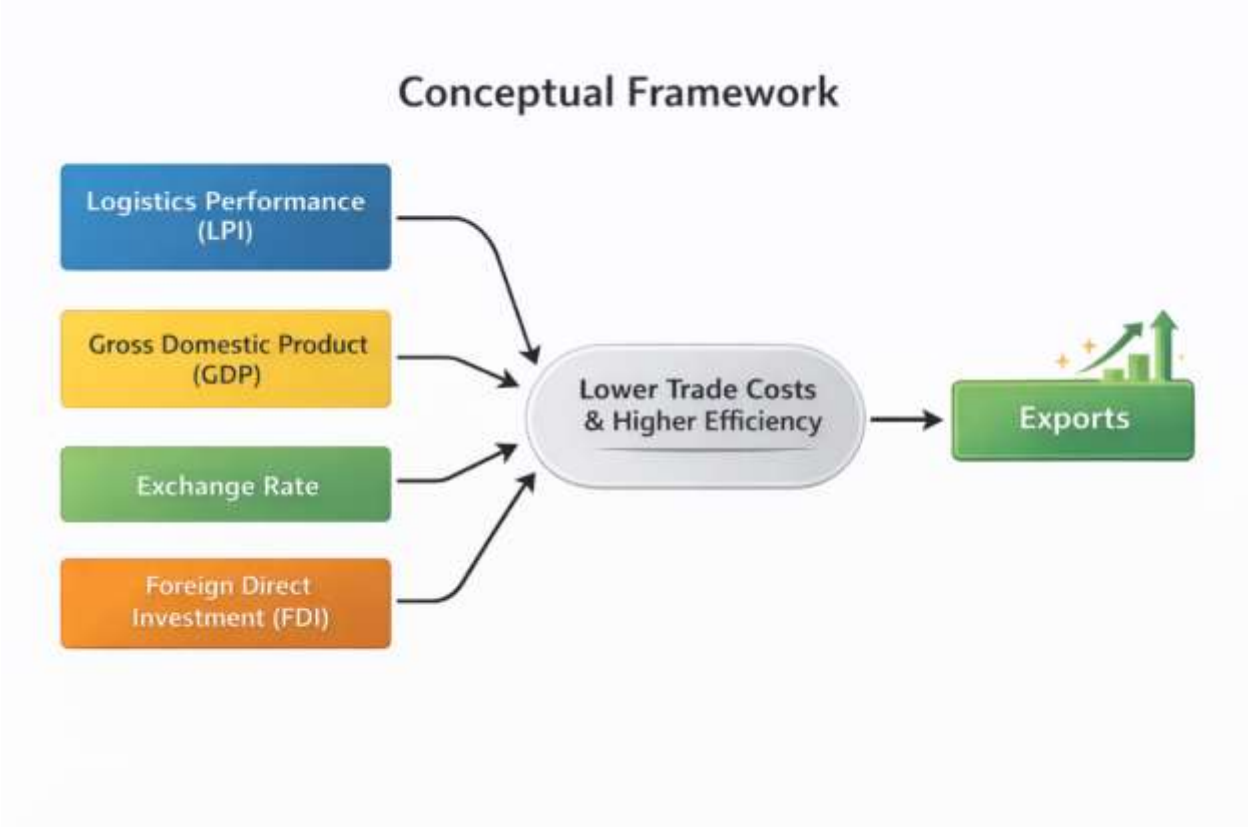
value chains is facilitated by efficient logistics, enabling the firms to reach distant markets, diversify exports, and comply with international standards. Within this framework, logistics performance exerts a direct influence on export outcomes by reducing trade frictions and an indirect influence by encouraging foreign investment, industrial upgrading, and participation in global production networks. Consequently, the theoretical expectation of this study is as follows: The enhancement of logistics performance has been demonstrated to result in increased export volumes. This phenomenon can be attributed to a reduction in trade costs, an improvement in delivery reliability, and a strengthening of international market access.

The conceptual framework is instrumental in translating the theoretical relationships into observable variables. The export performance of a given entity is modeled as a function of logistics efficiency and macroeconomic control variables. Logistics Performance Index (LPI) is a composite index that measures the quality of trade-related infrastructure, customs efficiency, service competence, and shipment reliability. Conceptually, logistics performance is expected to exert a positive influence on exports, while GDP is expected to scale export capacity, the exchange rate affects relative prices, and FDI supports export expansion through capital deepening and integration into global markets.



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Empirical framework

To operationalize the conceptual model, a log-linear export function is specified for a panel of post-Soviet countries:

$$Ln(EXPORT_t) = \beta_0 + \beta_1 \ln(LPI_t) + \beta_2 \ln(GDP_t) + \beta_3 \ln(ER_t) + \beta_4 \ln(FDI_t) + \varepsilon_t$$

Where: Table[1]

$Ln(EXPORT_t)$	Log of export values	Dependent variable
$Ln(LPI_t)$	Logistics Performance Index	Independent variable
$Ln(GDP_t)$	Economic output	Independent variable
$Ln(ER_t)$	Exchange rate	Independent variable
$Ln(FDI_t)$	Foreign direct investment	Independent variable
ε_t	Error term	Error term

The empirical analysis employs panel data estimation techniques. Initially, fixed-effects and random-effects models are estimated. The Hausman test is a methodological framework that is employed to ascertain the appropriate specification. Given the likelihood that unobserved country-specific characteristics (geography, institutional quality, inherited infrastructure) are correlated with logistics performance, the fixed-effects model is adopted as the baseline specification. To ensure reliable inference, cluster-robust standard errors at the country level are employed, with corrections made for: serial correlation, the presence of groupwise heteroskedasticity is indicated and the present study explores the phenomenon of within-country error dependence. All estimations are conducted using Stata.

A series of diagnostic tests have been implemented to validate the model assumptions. The Wooldridge test is a statistical procedure used to detect and measure serial correlation in a data set. The following is a modified Wald test for groupwise heteroskedasticity. The following model comparison tests are to be conducted between FE and RE specifications. A robustness check is performed by utilizing lagged logistics indicators. The presence of both autocorrelation and heteroskedasticity lends support to the utilization of cluster-robust standard errors.

The empirical procedure is outlined as follows: The following investigation will address the definition and descriptive statistics of panel structure and the following procedures are to be carried out: first, variable transformation; second, stationarity inspection. The initial estimate of the financial engineering FE and real estate RE is hereby indicated. Hausman specification test and the following diagnostic procedures are to be performed: Robust fixed-effects estimation and the

[1] Explanation of definition

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following discussion is intended to facilitate interpretation and policy-oriented discourse.

Results and Discussion

This section reports the empirical findings for the panel analysis of the relationship between logistics performance and export outcomes in post-Soviet economies. The dataset contains 98 country-year observations for 14 post-Soviet countries observed in the World Bank LPI survey waves (2007, 2010, 2012, 2014, 2016, 2018, and 2023). After variable transformations and removal of missing values in key regressors (notably LPI and exchange rate), the main estimation sample used in the baseline fixed-effects model consists of 90 observations (14 clusters).

Panel diagnostics show that the panel is strongly balanced with respect to the LPI survey waves (T=7 for each country), but the calendar-year time variable has gaps between survey waves (e.g., 2007, 2010, 2012, 2014, 2016, 2018, 2023). Because Stata's built-in lag operator (L.) assumes consecutive time periods, a manual lag of LPI was constructed after sorting by country and year. This manual lag reduces the usable sample to 86 observations due to the first observation in each country lacking a lagged value.

```
Variable |       Obs        Mean    Std. dev.       Min        Max
-------------+--------------------------------------------------------
Years |        98    2014.286    4.945059      2007      2023
Export |        98    5.56e+10    1.20e+11   8.36e+08   5.94e+11
LPI |        93     2.66684    .3549175      1.93   3.631688
GDP |        98    1.71e+11    4.48e+11   3.72e+09   2.21e+12
ER |        95    324.3422    1490.25   .2146078   11734.83
-------------+--------------------------------------------------------
FDI |        98    4.13e+09    9.57e+09  -1.00e+10   5.59e+10
```

Exports, GDP and the exchange rate ER were transformed using natural logarithms to obtain elasticities and stabilize variance. LPI was used in two alternative forms: (i) ln(LPI) and (ii) level LPI, as a robustness check. FDI can be zero or negative for some countries/years; therefore, FDI was transformed using the inverse hyperbolic sine function asinh(FDI), which behaves similarly to the log for large positive values but is defined at zero and for negative values. A sample indicator (sample_asinh) was generated to ensure complete cases on lnExport, lnGDP, lnER, lnLPI and asinhFDI; this yields 90 observations in the baseline models.

Table 2. Data structure and estimation samples (from Stata output)

Item	Value / Note
Countries (groups)	14

LPI survey years	2007, 2010, 2012, 2014, 2016, 2018, 2023
Raw observations	98
Baseline estimation sample (complete cases)	90
Lagged-LPI sample (requires manual lag)	86
Dependent variable	lnExport
Key regressor(s)	lnLPI / LPI (level) / LPI_lag_obs
Controls	lnGDP, lnER, asinhFDI, (gap_years in Model 3)

Baseline fixed-effects results

Model 1 estimates a within-country (fixed-effects) specification with cluster-robust standard errors at the country level. The model explains within-country variation in exports over LPI survey waves while controlling for time-varying macroeconomic factors. The overall model is statistically significant ($F(4,13)=11.05$, $p=0.0004$), and the within R^2 is 0.583, indicating that approximately 58% of within-country variation in lnExports is explained by the included regressors.

In Model 1, lnGDP is positive and highly significant ($\beta=0.921$, $p<0.01$). Interpreted as an elasticity, a 1% increase in GDP is associated with about a 0.92% increase in exports, holding other factors constant. The coefficient on asinhFDI is also positive and statistically significant ($\beta=0.00350$, $p=0.008$), implying that higher foreign investment inflows are associated with greater export performance. By contrast, lnLPI is not statistically significant in this baseline specification ($\beta=-0.136$, $p=0.768$). The wide confidence interval suggests that, once country fixed effects and macro controls are included, contemporaneous changes in lnLPI do not show a precisely estimated immediate effect on exports for this sample.

Robustness: using level LPI

Model 2 replaces lnLPI with LPI in levels. The main results for GDP and FDI remain stable: lnGDP remains positive and significant ($\beta=0.912$, $p<0.01$) and asinhFDI remains positive and significant ($\beta=0.00351$, $p=0.007$). The level LPI coefficient is near zero ($\beta=-0.0116$, $p=0.935$), again indicating no immediate contemporaneous association between logistics performance and exports in the within-country dimension.

Dynamics: lagged logistics

A key concern in logistics-trade relationships is timing: improvements in customs, infrastructure, service competence, and reliability may require time to translate into new contracts, new routes, and higher export volumes. To capture potential delayed effects, Model 3 uses a one-wave lag of LPI constructed manually

within each country (LPI_lag_obs) and controls for the length of the time gap between waves (gap_years). The model is statistically significant ($F(5,13)=12.26$, $p=0.0002$) with a within R^2 of 0.606.

The lagged LPI coefficient is positive and statistically significant at the 5% level ($\beta=0.223$, $p=0.043$). This result suggests that an improvement in logistics performance is associated with higher exports, but the effect materializes with a delay rather than contemporaneously. Substantively, because the dependent variable is lnExport and LPI is in levels, the coefficient can be interpreted as a semi-elasticity: a one-point increase in LPI (on the 1–5 scale) in the previous wave is associated with approximately 22% higher exports in the subsequent wave, all else equal. Given that realistic changes in LPI are smaller than one full point, a 0.1-point improvement would correspond to roughly 2.2% higher exports in the next wave.

The GDP elasticity remains positive and significant ($\beta=0.908$, $p<0.01$), consistent with scale effects. asinhFDI remains positive and significant ($\beta=0.00420$, $p=0.009$). The exchange rate coefficient is negative but not statistically significant in the FE specification ($\beta=-0.0285$, $p=0.569$), suggesting that within-country exchange-rate movements across LPI waves do not have a precisely estimated effect once country fixed effects and other controls are included. The gap_years control is also statistically insignificant ($p=0.628$), implying that, in this sample, variation in the time distance between survey waves does not systematically bias the estimated lagged LPI effect.

Model selection: fixed effects vs random effects

Both fixed-effects (FE) and random-effects (RE) estimators were estimated. The Hausman test (computed using non-clustered versions of FE0 and RE0 due to the standard restriction that Hausman cannot be used with cluster-robust VCE) rejects the null of no systematic difference between FE and RE coefficients ($\chi^2(4)=11.19$, $p=0.0246$). This indicates that the random-effects assumption $corr(u_i, X)=0$ is unlikely to hold; therefore, the fixed-effects estimator is preferred as the main specification.

Post-estimation diagnostics

Two standard diagnostics for panel models were conducted. First, the Wooldridge test for first-order autocorrelation in panel data reports $F(1,13)=21.661$ with $p=0.0005$, rejecting the null of no serial correlation. Second, the modified Wald test for groupwise heteroskedasticity in fixed-effects models reports $\chi^2(14)=842.68$ with $p=0.0000$, rejecting homoskedasticity across panels. Together, these diagnostics imply that the error structure is both serially correlated and heteroskedastic across countries.

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In response, the main FE results are reported with standard errors clustered at the country level, which are robust to arbitrary heteroskedasticity and within-country serial correlation when the number of clusters is sufficiently large. Because the number of clusters is relatively small (14 countries), inference should be interpreted with caution. As a robustness extension, the paper can also report alternative inference procedures suitable for few clusters (e.g., wild-cluster bootstrap p-values) or apply Driscoll–Kraay standard errors to account for cross-sectional dependence.

Discussion and interpretation

The empirical results point to three key findings. First, economic scale GDP is consistently and strongly associated with exports across all specifications, highlighting the central role of productive capacity and market size. Second, foreign investment inflows (asinhFDI) are positively associated with exports, consistent with channels such as capital deepening, technology transfer, and the formation of export-oriented production networks. Third, logistics performance does not appear to have an immediate contemporaneous effect in the within-country dimension, but the lagged specification reveals a positive and statistically significant relationship.

This timing pattern is economically plausible in the post-Soviet context. Improvements in logistics—such as more efficient border clearance, upgraded infrastructure, better service quality, and improved tracking—often require time for firms to reconfigure supply chains, find new buyers, comply with standards, and scale up shipments. Accordingly, the lagged-LPI effect suggests that reforms in trade logistics may yield export dividends with a delay, which is relevant for policy evaluation and reform sequencing.

Finally, the non-significance of the exchange rate in the FE specifications may reflect the fact that exchange-rate competitiveness effects are absorbed by country fixed effects and are difficult to identify at low frequency (survey waves), or that exchange rates in some countries are influenced by policy regimes that do not translate straightforwardly into export responses. Future work could refine this by using real effective exchange rates, adding time fixed effects, or interacting exchange rates with commodity dependence.

4.8 Reporting the regression table in the thesis

For clarity, the thesis can present a single consolidated table containing Model 1 (lnLPI), Model 2 (LPI level), and Model 3 (lagged LPI with gap_years), using clustered standard errors. The table generated in Stata (esttab) already provides this structure and can be inserted into the thesis as Table 4.2, with a short note that standard errors are clustered by country.

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Table 3. Fixed-effects estimates with clustered standard errors (from Stata esttab output)

Variable	Model 1 (lnLPI)	Model 2 (LPI)	Model 3 (lagged LPI)
lnLPI	-0.136 (0.454)		
LPI		-0.0116 (0.140)	
LPI_lag_obs			0.223** (0.0995)
lnGDP	0.921*** (0.156)	0.912*** (0.160)	0.908*** (0.157)
lnER	-0.0344 (0.0431)	-0.0347 (0.0435)	-0.0285 (0.0487)
asinhFDI	0.00350*** (0.00112)	0.00351*** (0.00110)	0.00420*** (0.00138)
gap_years			-0.00325 (0.00654)
N	90	90	86

Note: Standard errors in parentheses; ** p<0.05, *** p<0.01. The dependent variable is lnExport. Model 3 uses a manually constructed lag of LPI within each country (LPI_lag_obs).

Practical implication

From a policy perspective, the findings suggest that logistics reforms may matter for export growth, but the effect is more visible when allowing for implementation and adjustment time. Therefore, policy evaluation should not expect immediate export increases in the same LPI wave; instead, reforms should be assessed over subsequent waves. Given the presence of serial correlation and heteroskedasticity, robust inference is essential, and additional robustness checks with alternative standard errors are recommended.

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