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MIDDLE CORRIDOR AND TÜRKİYE'S FOREIGN TRADE PERFORMANCE: ECONOMIC IMPLICATIONS OF TRANSPORTATION DIPLOMACY

ORTA KORİDOR VE TÜRKİYE'NİN DIŞ TİCARET PERFORMANSI: ULAŞTIRMA DİPLOMASİSİNİN EKONOMİK YANSIMALARI

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Abstract: This study investigates how Türkiye's transportation diplomacy has structurally transformed its foreign trade performance since 2018. Focusing on strategic initiatives, such as the Middle Corridor, the Baku–Tbilisi–Kars railway, and the Türkiye Logistics Master Plan, this study empirically explores the role of institutional transportation reforms and transport-related service structures in shaping export and import dynamics. Using annual data covering 1990–2023, two ARDL models were estimated to analyze short- and long-run trade determinants, incorporating foreign direct investment, inflation, unemployment, income growth, and transportation service indicators. The results revealed a stable long-run equilibrium relationship in both export and import models. Foreign direct investment had a statistically significant positive effect on exports and imports in both the short and long run, highlighting the import-intensive and investment-driven structure of Türkiye's production system. Income growth negatively affects exports in the long run, indicating that economic expansion had been predominantly driven by domestic demand rather than export-oriented production. Although transportation service ratios are not statistically significant in the long run, the post-2018 structural reform dummy variable is positive and highly significant in both models, providing strong evidence that corridor-based institutional transportation reforms have structurally strengthened Türkiye's foreign trade performance. The findings contribute to the literature by providing quantitative evidence on the trade effects of transportation diplomacy and logistics-led institutional reforms and by presenting policy-relevant insights for designing infrastructure- and corridor-oriented foreign trade strategies.

Keywords: Transportation Diplomacy, Middle Corridor, Foreign Trade, ARDL, Logistics Policy

JEL: C22, C50, F13, R40

Öz: Bu çalışma, Türkiye'nin ulaştırma diplomasisinin 2018 sonrası dönemde dış ticaret performansını nasıl yapısal olarak dönüştürdüğünü incelemektedir. Orta Koridor stratejisi, Bakü–Tiflis–Kars demiryolu hattı ve Türkiye Lojistik Master Planı gibi girişimlere odaklanan çalışma, kurumsal ulaştırma reformlarının ve ulaştırma hizmetlerine ilişkin yapının ihracat ve ithalat dinamikleri üzerindeki etkisini ampirik olarak analiz etmektedir. 1990–2023 dönemine ait yıllık veriler kullanılarak iki ayrı ARDL modeli tahmin edilmiş; doğrudan yabancı yatırımlar, enflasyon, işsizlik, gelir artışı ve ulaştırma hizmetleri göstergeleri modele dâhil edilmiştir. Bulgular, her iki modelde de istikrarlı bir uzun dönem eşbütünleşme ilişkisine işaret etmektedir.

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Doğrudan yabancı yatırımlar, kısa ve uzun dönemde hem ihracat hem de ithalat üzerinde pozitif ve istatistiksel olarak anlamlı etkiye sahiptir. Gelir artışı, uzun dönemde ihracatı negatif etkilemekte olup, Türkiye’de büyümenin ağırlıklı olarak iç talep odaklı bir yapı sergilediğini göstermektedir. Ulaştırma hizmetleri katsayısı uzun dönemde anlamlı bulunmamakla birlikte, 2018 sonrası yapısal reformları temsil eden kukla değişkenin her iki modelde de pozitif ve yüksek derecede anlamlı olması, koridor temelli ulaştırma reformlarının dış ticaret performansını yapısal olarak güçlendirdiğini ortaya koymaktadır.

Anahtar Kelimeler: Ulaştırma Diplomasisi, Orta Koridor, Dış Ticaret, ARDL, Lojistik Politikası

1. Introduction

Türkiye’s geographical position at the junction of Asia, Europe, and Africa has historically positioned the country at the core of major continental trade routes. Transport policies in Türkiye initially developed around railway investments during the early Republican period, but shifted toward road-oriented strategies after the 1980s. Since the early 2000s, however, transport policy has increasingly evolved into a multimodal framework. In a global context where international trade is progressively digitalized and competitiveness is shaped by logistical efficiency, transportation infrastructure has also emerged as a key foreign policy instrument for Türkiye (Toprak, 2020). Accordingly, transportation diplomacy has been strategically designed to foster regional economic cooperation, strengthen geopolitical ties, and transform Türkiye into a regional logistics hub.

One of the most prominent pillars of Türkiye’s transportation diplomacy is the Middle Corridor, a multimodal transport route connecting China to Europe via Central Asia, the Caspian Basin, the South Caucasus, and Türkiye. As a terrestrial component of China’s Belt and Road Initiative (BRI), the Middle Corridor has the potential to convert Türkiye’s geostrategic position into a tangible economic advantage. Compared to the Northern Corridor, it provides a shorter, environmentally friendly, and time-efficient alternative to maritime transport routes (Sacar & Özdemir, 2022). Investments, such as the Baku–Tbilisi–Kars (BTK) railway, have operationalized this corridor and expanded Türkiye’s logistical integration with the Caucasus and Central Asia. The BTK line has made a significant contribution to Türkiye’s foreign trade volume by providing one of the few uninterrupted railway connections between China and Europe (Tümenbatur, 2021).

Beyond physical infrastructure, institutional and strategic frameworks have reshaped Türkiye’s transportation diplomacy. The Türkiye Logistics Master Plan (TLMP), introduced in 2018, constitutes a critical milestone. The TLMP aims to establish 25 logistics centers, increase the share of railways in freight transport, promote intermodal transport systems, and reduce logistics-related foreign trade costs through planned infrastructure investments. These objectives were designed to enhance Türkiye’s international competitiveness and reorganize its foreign trade structure. Following the implementation of the TLMP, noticeable changes have been observed in the composition and functioning of foreign trade, particularly in the post-2018 period.

The year 2018 also marks a turning point in Türkiye’s transportation-oriented foreign policy, marked by increased multilateral and regional alignments. The Middle Corridor has evolved from a mere transport route into a broader economic and

diplomatic platform that reinforces Türkiye's Eurasian presence (Kaya, 2024). Türkiye has actively integrated its transport infrastructure into regional frameworks, such as the Organization of Turkic States (OTS), TRACECA, and the Shanghai Cooperation Organization, while introducing bilateral and multilateral legal arrangements to facilitate transit flows (Beylur et al., 2022). These initiatives have stabilized Türkiye's economic ties with Central Asia and restructured its import-export flows, primarily through railway and transport services.

These developments have significantly altered both the composition of foreign trade and the modal structure of transportation. Since 2018, the relative share of road transport has declined, whereas maritime and rail transport have gained importance. The expansion of multimodal transport systems has reduced transport costs and delivery times, thereby reinforcing Türkiye's strategic position as a transit country. Consequently, transport services have become an increasingly important determinant of foreign trade performance (Günay et al., 2022). Despite this transformation, the macroeconomic implications of transportation diplomacy and logistics-oriented reforms on Türkiye's foreign trade structure have not yet been sufficiently quantified within an econometric framework.

Against this background, the primary purpose of this study is to empirically examine whether and to what extent Türkiye's post-2018 transportation diplomacy and logistics-oriented institutional reforms have structurally transformed its foreign trade performance.

Specifically, this study addresses three key research questions: (i) Do transportation services constitute a significant long-run determinant of Türkiye's exports and imports? (ii) Has the post-2018 transportation reform process, represented by the Middle Corridor strategy and the TLMP, generated a statistically significant structural break in foreign trade dynamics? (iii) How do macroeconomic factors, such as foreign direct investment, inflation, unemployment, and income growth interact with transportation services in shaping trade flows?

To answer these questions, the study employs the Autoregressive Distributed Lag (ARDL) bounds testing approach using annual data covering the period 1990–2023. This method provides the simultaneous estimation of short- and long-run relationships and the identification of structural breaks associated with post-2018 reforms.

This article thus provides a systematic econometric assessment of the structural transformation in Türkiye's foreign trade within the context of transportation diplomacy. Its main contribution lies in providing empirical evidence on the trade effects of logistics-led institutional reforms, thereby extending the literature on transportation economics and foreign trade by explicitly incorporating the role of transportation diplomacy as a structural determinant of trade performance. The findings also provide policymakers with an empirical basis for designing infrastructure-driven and diplomacy-oriented foreign trade strategies.

2. Related Literature

With globalization, the world is undergoing economic, social, and cultural integration. In this process, transportation plays a critical role by enabling the movement of passengers, goods, and vehicles from one point to another through

physical connections. In this context, the Lapis Lazuli corridor, inaugurated in 2018 and encompassing routes through Anatolia, the Caucasus, Russia, the Balkans, Europe, and North Africa, is a significant international transportation route. Such agreements, which foster the development of mutual trade, have attracted the attention of researchers, and the relevant literature continues to expand. In light of the significance of the topic, Özdemir and Çökerdenoğlu (2024) state that an efficient transportation corridor ensures the swift and secure continuation of trade. They report that reducing transit time leads to lower transportation costs, increased competitiveness, and decreased final product prices. Furthermore, transportation corridors are said to promote international and regional cooperation, thereby accelerating trade flows between countries. In addition, Toprak (2020) emphasizes that transportation policies are considered not only as economic tools but also as instruments of geopolitical and diplomatic significance. Recent studies, such as Çelikok and Talih (2023), also emphasize that transportation investments affect foreign trade not only through physical infrastructure capacity but also through institutional coordination, digital integration, and multimodal system efficiency. In particular, transportation systems enhance trade performance by improving accessibility, reliability, time efficiency, and safety, while digital and intelligent transport applications strengthen intermodal coordination and reduce transaction costs in logistics networks. These structural improvements enhance trade competitiveness by enabling faster, safer, and more integrated cross-border logistics operations.

As part of efforts to enhance international trade among countries, Yaşar (2021) investigates the determinants of export diversification using dynamic panel data analysis (System GMM) for 55 countries over the period 2005–2019. The author emphasizes that export diversification is a critical factor that not only influences trade performance but also affects macroeconomic stability and economic growth. Özgün Acar and Benli (2021) examined the impact of logistics performance on foreign trade from both theoretical and empirical perspectives. The study highlights that logistics performance has a strong and positive effect on exports. Based on the static panel data analysis used in this research, it was concluded that logistics performance positively affects exports in both OECD countries and low- to middle-income countries; however, it does not have a statistically significant effect on imports. Gasimova and Yurcu (2023) evaluated the potential impacts of the Zangezur Corridor on Azerbaijan's foreign trade and logistics activities using a SWOT analysis. The findings of the study reveal that the corridor presents significant strategic, economic, and logistical opportunities for Azerbaijan; however, certain weaknesses and threats should not be overlooked.

Yergin (2022) examined the impact of the Customs Union between Türkiye and the 15 member countries of the European Union on intra-industry trade, particularly in the "machinery and transport equipment" sector. In the early years of the Customs Union, Türkiye's foreign trade was negatively affected, with imports increasing while exports remained relatively limited. As a result, the Customs Union process aligns with the "convergence paradigm" for Türkiye, meaning that the integration process has made Türkiye more competitive over time. Ferik and Dil Şahin (2024) explain the relationship between logistics management and foreign trade performance through a literature review method. In this context, it is suggested that improvements in Türkiye's logistics management could enhance its foreign trade performance.

In the international literature, the study by Malkowska and Malkowski (2021) aims to analyze the structure and role of transport services in Poland's foreign trade with

European Union (EU) countries, particularly within the framework of sustainable development. Focusing on the period between 2010 and 2018, the authors find that Poland has significantly increased its exports of transport services, achieving a consistent trade surplus in this sector. Road transport, especially, has emerged as the dominant mode, contributing substantially to Poland's economic growth and competitiveness within the EU market. However, the authors also underline the rising external costs of transport, such as environmental degradation and carbon emissions, calling attention to the need for sustainable practices. As a policy recommendation, they advocate implementing green transport strategies, including the adoption of low-emission vehicles, investing in renewable energy-powered infrastructure, and creating digital platforms to optimize multimodal logistics. These measures are expected to support both environmental objectives and long-term competitiveness in international transport markets. An et al. (2021) aim to investigate the relationship between green logistics operations and the triple bottom line, economic, environmental, and social performance, across 65 Belt and Road Initiative (BRI) countries. Their findings show that Chinese outward foreign direct investment (FDI) significantly enhances green logistics infrastructure, which in turn improves trade performance, reduces CO₂ emissions, and supports social well-being through better institutional quality and health indicators.

Vinokurov et al. (2022) assess the freight potential of the International North–South Transport Corridor and its strategic significance for enhancing Eurasian connectivity, particularly in the context of shifting geopolitical dynamics and trade patterns. The authors highlight the corridor's potential to significantly reduce transport times and enhance trade between Russia, South Asia, and the Middle East. As a policy recommendation, the study calls for coordinated investments in transport infrastructure, harmonization of transit regulations, and digitalization of logistics operations to fully realize the corridor's trade and development potential across Eurasia. The purpose of Hussain (2023) is to examine the long-run effects of air transportation, railway transportation, and trade openness on inbound and outbound tourism in 140 Belt and Road Initiative (BRI) countries. The findings reveal that both air and railway transport, along with trade openness, have a significant and positive impact on tourism flows. Granger causality tests indicate mostly bidirectional relationships between these variables. As a policy recommendation, the study emphasizes that BRI countries should invest in transport infrastructure, enhance travel-related services, and promote trade liberalization to boost tourism development. These efforts are expected to improve accessibility, foster economic growth, and strengthen international tourism networks.

Chen and Li (2021) examine the economic impact of transportation infrastructure investment under China's Belt and Road Initiative (BRI), employing actual investment data and a computable general equilibrium (CGE) model. Their findings show that BRI-related infrastructure investments generally reduce trade costs and generate positive effects on GDP and welfare, especially in Central and West Asia and South and Southeast Asia, although the impacts remain uneven across regions. The study recommends that policymakers implement infrastructure investments more strategically and equitably, with a focus on underdeveloped regions and improved empirical assessment tools to guide future development decisions. Song and Lee (2022) analyze the effect of logistics performance on international trade through a gravity model, focusing on Korea's key export and import product groups. The results show that logistics components, such as infrastructure, shipment arrangements, and

timeliness significantly influence trade volume, with varying impacts across different commodity categories. Accordingly, the study recommends improving customs procedures, strengthening transport infrastructure, and enhancing tracking systems to reduce trade costs and enhance international competitiveness.

3. Data and Empirical Framework

To analyze Türkiye's foreign trade, we utilize several variables. All the data we use is compiled from the World Bank (2025). Table 1 presents the definitions and summary statistics of these variables.

Table 1. Summary Statistics of the Key Variables

Variable	Definition	Mean	Std. Dev.	Min.	Max.
Export	Exports of goods and services (% of GDP)	23.673	5.803	13.365	38.584
Import	Imports of goods and services (% of GDP)	26.029	5.635	16.635	42.586
FDI	Foreign direct investment, net inflows (% of GDP)	1.218	0.835	0.305	3.623
CPI	Inflation, consumer prices (annual %)	36.956	31.946	6.251	105.215
Growth	GDP per capita growth (annual %)	3.441	4.444	-6.915	10.429
Unemployment	Unemployment, total (% of total labor force)	9.794	1.922	6.495	14.026
Transportation_ex	Transport services (% of service exports, BoP)	23.157	10.160	11.305	40.976
Transportation_im	Transport services (% of service imports, BoP)	32.724	7.250	20.222	44.518

According to the data in Table 1, exports of goods and services constitute an average of 23.67% of GDP, and this ratio can fall to low levels, such as 13.37% or reach high levels, such as 38.58%. Similarly, the ratio of imports of goods and services to GDP is an average of 26.03% and ranges from 16.64% to 42.59%. This situation reveals that foreign trade plays an important role in the economy in general and can vary over time. Foreign direct investment inflows (FDI) are at an average of 1.22% of GDP, with the lowest observed at 0.31% and the highest at 3.62%. These values may suggest that foreign investment in the country is limited but increases in certain periods. The inflation rate measured by the consumer price index (CPI) is at a very high level of 36.96% on average and its standard deviation is also quite large (31.95%). Inflation that varies between a very wide range, such as the lowest 6.25% and the highest 105.22%, indicates that the economy is experiencing severe periodic instabilities.

The average per capita GDP growth rate is 3.44%. However, this variable can fall to a negative value of -6.92% or reach rates as high as 10.43%. This wide range indicates that the growth performance is volatile from year to year. The unemployment rate is 9.79% on average. This rate ranges from 6.50% to 14.03% and has a relatively lower standard deviation. This may indicate that the unemployment rate follows a more stable course than other macroeconomic indicators. As an indicator of the impact of infrastructure services on foreign trade, the share of transportation in service exports is 23.16% on average and ranges from 11.31% to 40.98%. In addition, the high standard deviation of this variable (10.16%) indicates that it can show large fluctuations over time. On the other hand, the share of transportation services in

imports is relatively high, with an average of 32.72%. The standard deviation is relatively low at 7.25%, suggesting this variable has a more stable share. In general, when the data are examined, it is seen that there are significant fluctuations in economic indicators, while foreign trade and transportation services are in a strong position. However, high inflation rates and variable growth rates stand out as remarkable risk factors for economic stability.

The World Bank's Logistics Performance Index (LPI) is one of the most widely used composite indicators for evaluating countries' logistics efficiency, i covering customs performance, infrastructure quality, shipment reliability, logistics competence, tracking and tracing capacity, and delivery timeliness. However, LPI is reported only for selected benchmark years (2007, 2010, 2012, 2014, 2016, 2018, and 2023). This irregular and sparse data structure prevents its integration into long-run annual time-series analyses covering extended periods, such as 1990–2023. Therefore, although LPI provides valuable cross-sectional insights, it is not suitable for the time-series-based ARDL framework employed in this study. Similarly, the Liner Shipping Connectivity Index (LSCI), published by UNCTAD, is frequently used to capture a country's integration into global maritime transport networks and its container shipping connectivity. Despite its strong relevance for corridor-based and transit-oriented trade analyses, LSCI data are available only for 2006–2021, limiting their applicability for long-term time series models spanning multiple decades. Consequently, while LSCI is conceptually highly relevant to transportation diplomacy and corridor integration, its restricted temporal coverage prevents its direct inclusion in extended ARDL estimations, such as those employed in this study.

Among the methods commonly used in time series analyses is the model of the Autoregressive Distributed Lag (ARDL) model. The model developed by Pesaran et al. (2001) is used because the following ARDL model can be used to estimate short- and long-run effects, the stationarity orders of the variables used can be different from one another, and it can be applied for a small sample. In that case, we begin our analysis by considering the ARDL specification, as given in equation (1).

$$\begin{aligned}
 export_t = & \beta_0 + \sum_{i=1}^p \beta_{1i} export_{t-i} + \sum_{i=0}^{q1} \beta_{2i} fdi_{t-i} + \sum_{i=0}^{q2} \beta_{3i} cpi_{t-i} \\
 & + \sum_{i=0}^{q3} \beta_{4i} growth_{t-i} + \sum_{i=0}^{q4} \beta_{5i} unemployment_{t-i} \\
 & + \sum_{i=0}^{q5} \beta_{6i} transport_ex_{t-i} + \beta_7 DUM + u_t
 \end{aligned} \quad (1)$$

where p , $q1$, $q2$, $q3$, $q4$, and $q5$ are the optimum lag values to be determined by the information criteria. *Export* shows exports of goods and services, *fdi* represents net foreign direct investments inflow, *cpi* is the inflation rate, *unemployment* is the unemployment rate, and *transport_ex* stands for the transportation services in exports human capital. While u_t denotes the error term, DUM variable serves as a dummy variable taking the value of 1 in 2018 and beyond, and 0 otherwise.

We may define equation (1)'s relationship in the error correction form as follows.

$$\begin{aligned}
\Delta export_t = & \alpha_0 + \sum_{i=1}^p \beta_{1i} \Delta export_{t-i} + \sum_{i=0}^{q1} \beta_{2i} \Delta fdi_{t-i} + \sum_{i=0}^{q2} \beta_{3i} \Delta cpi_{t-i} \\
& + \sum_{i=0}^{q3} \beta_{4i} \Delta growth_{t-i} + \sum_{i=0}^{q4} \beta_{5i} \Delta unemployment_{t-i} \\
& + \sum_{i=0}^{q5} \beta_{6i} \Delta transport_ex_{t-i} + \beta_7 export_{t-1} + \beta_8 fdi_{t-1} \\
& + \beta_9 cpi_{t-1} + \beta_{10} growth_{t-1} + \beta_{11} unemployment_{t-1} \\
& + \beta_{12} transport_ex_{t-1} + \beta_{13} DUM + e_t
\end{aligned} \tag{2}$$

In equation (2), the bound test can analyze the existence of a long-term cointegration among the variables. In this regard, the following hypotheses are tested. If the computed F-statistic exceeds the upper critical bound ($F_{stat} > F_{ub}$), the null hypothesis of no cointegration is rejected, indicating the presence of a cointegrating relationship among the variables. Conversely, if the F-statistic falls below the lower bound ($F_{stat} < F_{lb}$), the null hypothesis cannot be rejected. When the F-statistic lies between the lower and upper bounds ($F_{lb} < F_{stat} < F_{ub}$), the test results are inconclusive.

$$H_0: \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = \beta_{12} = 0 \tag{3}$$

H_1 : At least one of the parameters is different from zero.

In other words, the null hypothesis indicates the absence of cointegration, while the alternative hypothesis suggests that a cointegrated relationship exists among the variables. Then, we can construct a conditional error correction model to analyze the short-run dynamics.

$$\begin{aligned}
\Delta export_t = & \alpha_0 + \sum_{i=1}^p \alpha_{1i} \Delta export_{t-i} + \sum_{i=0}^{q1} \alpha_{2i} \Delta fdi_{t-i} + \sum_{i=0}^{q2} \alpha_{3i} \Delta cpi_{t-i} \\
& + \sum_{i=0}^{q3} \alpha_{4i} \Delta growth_{t-i} + \sum_{i=0}^{q4} \alpha_{5i} \Delta unemployment_{t-i} \\
& + \sum_{i=0}^{q5} \alpha_{6i} \Delta transport_ex_{t-i} + \gamma ect_{t-1} + \delta DUM_t + e_t
\end{aligned} \tag{4}$$

In equation (4), the γ coefficient represents the speed of adjustment and shows how rapidly short-term deviations reach equilibrium in the long term.

The empirical framework we have provided so far explains the export model. Employing the same methodology, we can also analyze the import model. In the analysis of the import model, we can replace export with import, and transport services in export with transport services in import in equations (1)-(4).

4. Empirical Results

In this section of the study, before moving ahead with the ARDL models to examine the effect of transportation diplomacy on the foreign trade structure of Türkiye, the stationarity levels of the time-series study variables are analyzed. It is very significant to the validity of the model in econometric modeling how the variables are stationary at their levels, that is, how their variances and their means are stable over time. To this end, in Table 2, ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) tests are conducted in order to test the null hypothesis of the unit root presence in the variables. Thus, by identifying the degree of the series' integration, it is determined whether the level of the ARDL approach's necessity, the mixed state of stationarity of the I(0) and I(1) series, has been realized.

Table 2. Unit Root Tests

Variables	ADF test		PP test	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Export	-0.809	-3.130	-1.771	-3.158
Δ Export	-6.440***	-6.286***	-6.915***	-6.654***
Import	-1.835	-3.471*	-1.574	-3.274*
Δ Import	-5.769***	-5.282***	-10.419***	-9.656***
FDI	-2.312	-2.377	-2.203	-2.266
Δ FDI	-5.224***	-5.170***	-7.543***	-9.036***
CPI	-1.316	-0.958	-1.278	-0.887
Δ CPI	-5.852***	-4.080**	-5.854***	-6.004***
Growth	-5.934***	-6.057***	-6.178***	-8.218***
Unemployment	-1.913	-2.169	-1.979	-2.202
Δ Unemployment	-4.707***	-4.668***	-4.892***	-4.803***
Transportation_ex	-0.050	-3.376*	-0.607	-3.243*
Δ Transportation_ex	-7.965***	-7.861***	-8.144***	-8.602***
Transportation_im	-1.940	-2.042	-1.940	-2.042
Δ Transportation_im	-5.800***	-5.686***	-5.811***	-5.691***

Unit root tests indicated that most of the series were statistically non-stationary at the level. However, ADF and PP tests provided significant results at first differences of the variables, confirming the nature of the variables we are dealing with as I(1) and of first order integration. The majority of the series being stationary at significant values for both the fixed and trend models provides strength to the results. Virtually all macroeconomic variables, such as transport services, the unemployment rate, foreign direct investment, and the price level possess proper levels of difference to be employed in the analysis. The discovery that the variables not being stationary at both levels and in differences therefore justifies the choice of ARDL modeling from a methodological point of view. These results confirm the appropriateness of the ARDL approach, which provides the short-run dynamics to be analyzed alongside the long-run association.

The Bounds Test, applied to test for long-run relationships in ARDL modeling, is a straightforward tool for checking cointegration between the variables. The F-statistic obtained under the jurisdiction of this test is interpreted by comparing it with the lower and upper bound critical values provided at certain significance levels. If the F-statistic value is higher than the upper bound critical value, then there is evidence of a long-run relationship between the series.

The optimal lag length structure of the ARDL models is determined using information criteria. Given the annual frequency of the data and the relatively limited sample size, a maximum lag length of three is initially allowed for each variable. Among the 3,072 alternative model specifications, the Schwarz Information Criterion (SIC) is employed to select the most parsimonious model with the best goodness-of-fit. Accordingly, the final ARDL models—ARDL(2,2,1,3,1,0) for exports and ARDL(3,2,0,3,3,0) for imports—are selected based on the minimum SIC values.

Table 3. Bounds Test Results

Model	F-Stat	Significance level	Critical Values for Lower Bounds	Critical Values for Upper Bounds
ARDL (2,2,1,3,1,0)	8.232	10%	2.331	3.417
ARDL (3,2,0,3,3,0)	7.087	5%	2.804	4.013
		1%	3.9	5.419

In Table 3, the F-statistic for the first model (ARDL 2,2,1,1,3,1,0) for the export side of foreign trade is 8.232. This is significantly higher than the upper value of 3.417 at the 10% significance level, and it confirms that a long-run cointegration relationship exists between the variables in the model. In model 2 for imports (ARDL 3,2,0,3,3,3,0), the F-statistic is 7.087, which is higher than the upper bound critical value of 4.013 at the 5% significance level. The presence of a long-run relationship in both models is thus statistically established.

These results confirm that the macroeconomic and sectoral variables of Türkiye's foreign trade performance, especially in transportation services, exhibit long-term relationship. The need for cointegration for examining both the short-run variations and long-run patterns under the ARDL approach is thus met.

Table 4. Export ARDL (2,2,1,3,1,0) Regression

VARIABLES	Coefficient	P-val
ECT_{t-1}	-0.450	0.002
Long Run Estimates		
FDI	4.718	0.040
CPI	-0.031	0.674
Growth	-1.341	0.047
Unemployment	-2.521	0.078
Transportation	0.139	0.334
Constant	44.28	0.020
Short Run Estimates		
$\Delta Export_{t-1}$	-0.223	0.039
ΔFDI	1.902	0.000
ΔFDI_{t-1}	-1.416	0.005
ΔCPI	0.114	0.000
$\Delta Growth$	0.105	0.082
$\Delta Growth_{t-1}$	0.543	0.000
$\Delta Growth_{t-2}$	0.315	0.000
$\Delta Unemployment$	0.587	0.055
Dum	5.918	0.000
Diagnostic tests		
	Test-Statistic	P-val
Heteroscedasticity test	18.717	0.227
Serial Correlation LM test	4.251	0.119
Jarque-Bera test	0.901	0.637
Ramsey reset test	0.010	0.920
CUSUM	Stable	
CUSUMQ	Stable	

The ARDL model results reported in Table 4 reveal statistically significant dynamics in both the short and long run for Türkiye's export performance. The error correction term is negative and highly significant, confirming the existence of a stable long-run equilibrium relationship among the variables. The magnitude of the adjustment coefficient indicates that deviations from the long-run equilibrium are corrected relatively rapidly, implying a strong convergence mechanism within the export system.

An examination of the long-run coefficients indicates that foreign direct investment exerts a positive and statistically significant effect on exports, suggesting that foreign capital inflows enhance production capacity and export-oriented supply potential in Türkiye. In contrast, per capita income growth negatively affects exports in the long run, supporting the argument that economic growth in Türkiye has been predominantly driven by domestic demand rather than export-oriented expansion. The unemployment rate carries a negative coefficient and is marginally significant, implying that labor market rigidities and rising unemployment constrain export capacity by limiting effective production potential. The long-run coefficient of transport services remains statistically insignificant, indicating that the structural contribution of transportation infrastructure to exports materializes primarily through institutional and policy-based channels rather than through contemporaneous service ratios. Similarly, inflation does not exert a statistically significant long-run effect on export performance.

Short-run dynamics reveal a markedly different adjustment mechanism. The lagged change in exports is negative and statistically significant, indicating partial correction behavior and short-term inertia in export adjustments. Most notably, changes in foreign direct investment have a strong and positive impact on exports in the short run, suggesting that new capital inflows immediately stimulate export-oriented production and external sales. The short-run effects of economic growth are positive but weaker and partly lag-dependent, reflecting that growth contributes to exports mainly through delayed production and capacity channels rather than contemporaneous demand effects.

Inflation exerts a positive, statistically significant effect on exports in the short run, suggesting that temporary price and exchange-rate-related competitiveness gains support export performance through price-based channels. The unemployment rate exhibits a positive and marginally significant short-run effect, which may reflect short-term cost-compression mechanisms or cyclical labor adjustments that temporarily enhance export competitiveness.

The structural break dummy variable capturing the post-2018 reform period is positive and highly significant, providing strong empirical evidence that Türkiye's transportation diplomacy, logistics reforms, and infrastructure-oriented institutional transformations after 2018 have significantly strengthened export performance. Developments, such as the operationalization of the Middle Corridor, the Baku–Tbilisi–Kars railway, and the implementation of the Türkiye Logistics Master Plan, have reduced delivery times, lowered logistics costs, and enhanced Eurasian trade connectivity, thereby translating transportation diplomacy into tangible export gains.

Finally, diagnostic test results confirm the robustness and statistical adequacy of the model. The absence of serial correlation and heteroskedasticity, together with normal

residual distribution and stable CUSUM and CUSUMQ statistics, indicates that the estimated coefficients are reliable and that the model is correctly specified.

Table 5. Import ARDL (3,2,0,3,3,0) Regression

VARIABLES	Coefficient	P-val
ECT_{t-1}	-0.595	0.000
Long Run Estimates		
FDI	7.005	0.012
CPI	0.153	0.001
Growth	-0.414	0.413
Unemployment	2.082	0.001
Transportation	-0.193	0.118
Short Run Estimates		
$\Delta Import_{t-1}$	-0.577	0.000
$\Delta Import_{t-2}$	-0.453	0.004
ΔFDI	2.924	0.000
ΔFDI_{t-1}	-2.117	0.004
$\Delta Growth$	0.535	0.000
$\Delta Growth_{t-1}$	0.873	0.000
$\Delta Growth_{t-2}$	0.445	0.000
$\Delta Unemployment$	1.228	0.004
$\Delta Unemployment_{t-1}$	-0.862	0.029
$\Delta Unemployment_{t-2}$	-1.787	0.001
Dum	4.986	0.000
Diagnostic tests		
	Test-Statistic	P-val
Heteroscedasticity test	15.792	0.539
Serial Correlation LM test	4.380	0.112
Jarque-Bera test	0.114	0.945
Ramsey reset test	0.307	0.589
CUSUM	Stable	
CUSUMQ	Stable	

The ARDL model results reported in Table 5 reveal statistically significant dynamics in both the short and long-run for Türkiye's import performance. The error correction term is negative and highly significant, confirming the existence of a stable long-run equilibrium relationship among the variables. The magnitude of the adjustment coefficient indicates a rapid speed of convergence, implying that deviations from long-run equilibrium are corrected swiftly.

The long-run coefficients indicate that foreign direct investment has a strong, statistically significant positive effect on imports. This finding reflects the structural dependence of Türkiye's production system on imported intermediate and capital goods, whereby increased foreign capital inflows directly translate into higher import demand. Inflation also exerts a positive, highly significant long-run impact on imports, suggesting that price-level and exchange-rate mechanisms amplify import demand in the long run. Moreover, the unemployment rate has a positive and significant coefficient, indicating that rising unemployment weakens domestic production capacity and increases reliance on imported goods. By contrast, per capita income growth and transportation services are not statistically significant in the long run, suggesting that structural import dependence in Türkiye is primarily shaped by financial and labor-market channels rather than by contemporaneous transportation service intensity.

Short-run dynamics reveal a markedly active and asymmetric adjustment mechanism. The lagged changes in imports are negative and statistically significant, confirming short-term correction behavior and inertia in import adjustments. Most notably, contemporaneous changes in foreign direct investment have a strong and positive effect on imports, indicating that new capital inflows immediately generate import demand through imported inputs and investment goods. The lagged change in foreign direct investment, however, has a negative and significant effect, suggesting that initial import surges induced by new investments are followed by partial corrections in subsequent periods.

Economic growth exerts a consistently positive and highly significant effect on imports in the short run across all lags, underscoring Türkiye's import-intensive growth process. This finding provides robust evidence that domestic-demand-driven expansion systematically stimulates import demand. Unemployment also displays significant short-run effects: while contemporaneous increases in unemployment raise imports, higher unemployment in preceding periods significantly suppresses import demand, reflecting cyclical and adjustment-related dynamics in domestic production and consumption behavior.

The post-2018 structural break dummy variable is positive and highly significant, providing strong empirical evidence that Türkiye's transportation diplomacy and logistics-oriented reforms implemented after 2018 have substantially increased import flows. Developments associated with the Middle Corridor, the Baku–Tbilisi–Kars railway, and the Türkiye Logistics Master Plan have facilitated cross-border trade, reduced transaction costs, and strengthened Eurasian connectivity, thereby translating institutional transportation reforms into tangible increases in import volumes.

Finally, diagnostic test results confirm the robustness of the model. The absence of heteroskedasticity and serial correlation, together with normally distributed residuals and stable CUSUM and CUSUMQ statistics, indicates that the model is correctly specified and that the estimated coefficients are statistically reliable.

5. Discussion and Conclusion

This study investigates how Türkiye's foreign trade performance has been affected by the transformation of transportation diplomacy since 2018. In particular, the study empirically examines the effects of institutional initiatives, such as the Middle Corridor strategy, the Baku–Tbilisi–Kars railway, and the Türkiye Logistics Master Plan on export and import dynamics using annual macroeconomic data and ARDL modeling. The statistical significance of the post-2018 structural break dummy variable in both export and import equations provides strong empirical confirmation that transportation-oriented institutional reforms have generated a structural transformation in Türkiye's foreign trade performance. In this respect, transportation services are not treated merely as physical infrastructure inputs but as a strategic institutional channel reshaping the structural configuration of foreign trade. The findings are consistent with Özdemir and Çökerdenoğlu (2024), who emphasize that efficient transportation corridors strengthen the continuity and security of trade flows, and with Gasimova and Yurcu (2023), who underline the strategic and economic potential of corridor-based integration.

The export model indicates that foreign direct investment has a positive and statistically significant long-run effect on exports, whereas per capita income growth exerts a negative influence. This supports the argument that Türkiye's growth pattern

has been predominantly domestic-demand-oriented rather than export-led. The unemployment rate carries a negative and marginally significant coefficient in the long run, suggesting that labor market constraints reduce export capacity by limiting effective production potential. Although transportation services do not exhibit a statistically significant long-run coefficient, the strong, highly significant post-2018 dummy variable indicates that the contribution of transportation diplomacy to export performance materializes primarily through institutional and policy-driven structural reforms rather than through contemporaneous service ratios. Inflation does not exert a statistically significant long-run effect on exports, implying that price-level changes are not a dominant determinant of long-term export competitiveness.

The import model reveals that foreign direct investment, inflation, and unemployment have strong and statistically significant positive effects on imports in the long run. These findings indicate that Türkiye's production structure remains heavily dependent on imported intermediate and capital goods and that foreign capital inflows amplify this dependency. In contrast, income growth and transportation services do not significantly affect imports in the long run. Short-run dynamics provide robust evidence that economic growth and contemporaneous foreign direct investment strongly stimulate imports, underscoring the import-intensive nature of domestic-demand-driven expansion. The post-2018 structural break dummy variable is also positive and highly significant in the import model, confirming that transportation-oriented institutional reforms have facilitated cross-border trade flows and increased import volumes.

Overall, the empirical findings suggest that Türkiye's transportation diplomacy has contributed to foreign trade primarily through structural and institutional transformation rather than through contemporaneous transportation service intensity. Corridor-based integration, logistics infrastructure reforms, and regulatory facilitation mechanisms have significantly improved Eurasian connectivity, reduced transaction costs, and strengthened Türkiye's role as a transit and logistics hub. These results are consistent with the broader literature emphasizing the strategic role of logistics and transportation infrastructure in enhancing trade performance (Özgün Acar & Benli, 2021; Chen & Li, 2021; Malkowska & Malkowski, 2021).

From a policy perspective, the findings suggest that continued investment in transportation infrastructure at both national and local levels remains critical. Strengthening the connecting lines of the Baku–Tbilisi–Kars railway, enhancing digital transit documentation systems, and fully operationalizing the 25 logistics centers envisaged under the Türkiye Logistics Master Plan would reduce transportation costs and delivery times while improving exporters' market access. Moreover, expanding blockchain-based customs procedures, accelerating border clearance processes, and promoting public–private partnership mechanisms for railway investments would strengthen multimodal integration. In line with decarbonization targets, green logistics policies and the adoption of alternative-fuel transportation technologies would strengthen both economic competitiveness and environmental sustainability.

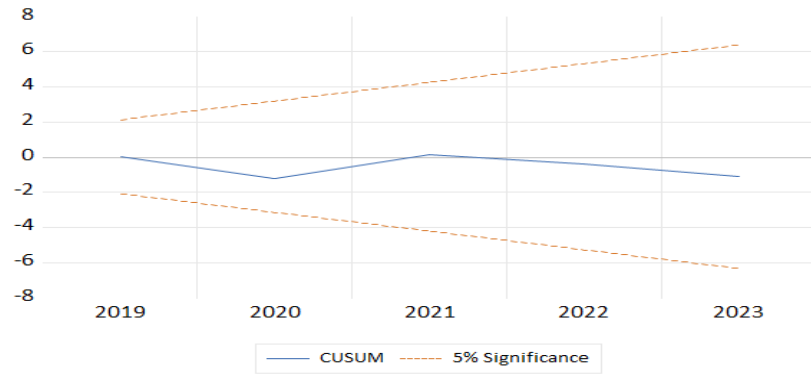
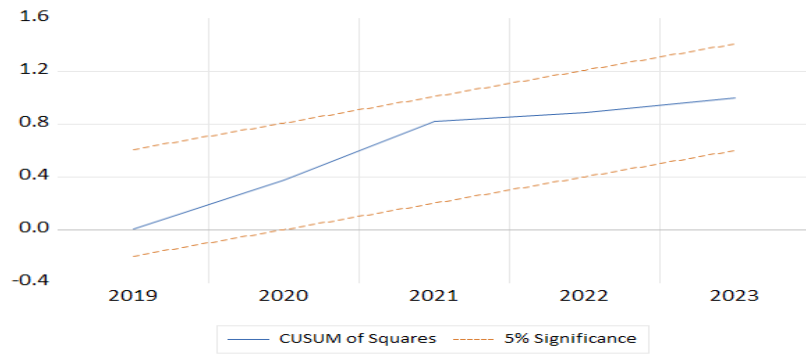
Despite the robustness of the empirical findings, several limitations should be acknowledged. Türkiye has undergone multiple structural transformations driven by economic crises and policy shifts. Although the post-2018 period is treated as a structural break due to its distinctive institutional and diplomatic transformation in transportation policies, incorporating multiple break periods within the ARDL

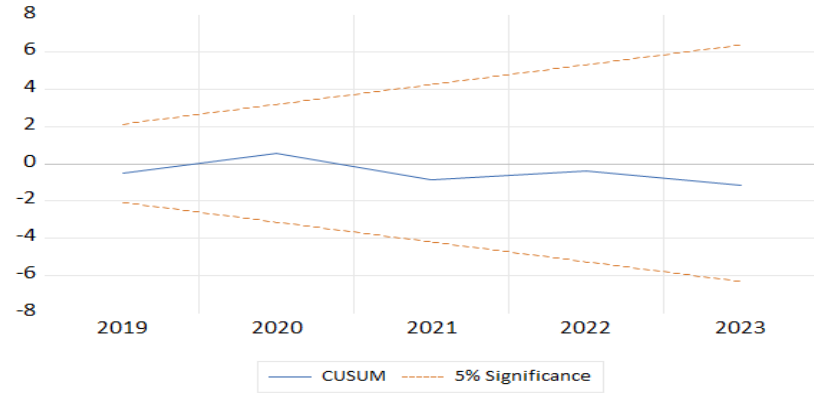
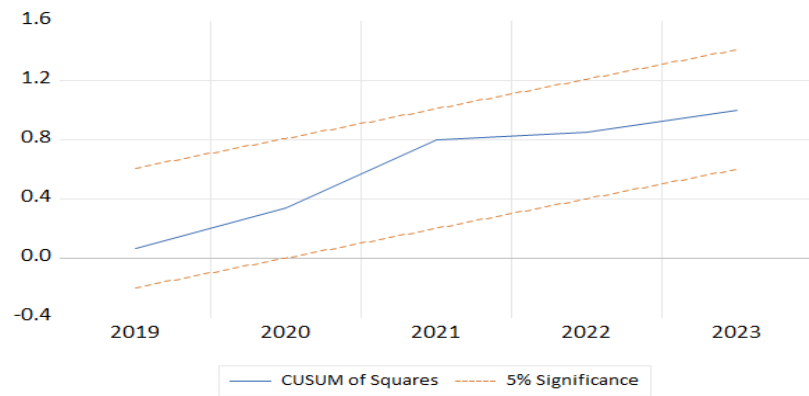
framework leads to diagnostic and stability issues, given the annual data structure and limited sample size. Although composite logistics indices, such as the Logistics Performance Index (LPI) and the Liner Shipping Connectivity Index (LSCI), provide valuable insights into logistics efficiency and maritime connectivity, their limited temporal coverage prevents their direct integration into long-horizon annual time-series models. Further studies may incorporate these indices within panel or shorter-horizon time-series frameworks to further validate the effects of corridor-based transportation diplomacy. Accordingly, future studies may explicitly account for multiple structural breaks using alternative empirical methodologies. Another limitation concerns the measurement of transportation activities. Due to data availability constraints, transportation services are represented by aggregate balance-of-payments-based proxy indicators rather than direct measures of corridor-specific performance, logistics efficiency, or institutional effectiveness. Future research may employ disaggregated, corridor-level, or composite logistics performance indicators to capture the multidimensional nature of transportation diplomacy better.

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Appendix**Figure A1. Export Cusum****Figure A2. Export Cusumq**

**Figure A3. Import Cusum****Figure A4. Import Cusumq**