The Impact of Logistic Services on Algerian Trade Dynamics: An Econometric Analysis

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Summary: This study examines the impact of logistic services on Algeria's trade dynamics, focusing on export growth and competitiveness. Using data from the World Bank's Logistics Performance Index (LPI) from 2007 to 2023, the objective is to analyze how logistics dimensions—specifically customs efficiency, infrastructure quality, and timeliness—affect export volumes, a key trade performance indicator. Through econometric modeling in R software, including correlation, multiple regression, the study assesses the relationship between LPI scores and export volumes.

Results show that improvements in customs efficiency, infrastructure quality, and timeliness significantly enhance Algeria's exports, while logistics competence and tracking remain areas needing improvement. These findings underscore the need for targeted infrastructure investments and logistics reforms to strengthen Algeria's trade competitiveness and support economic diversification beyond hydrocarbons.

Keywords: Logistics Performance; Algeria; Trade Dynamics; Export Competitiveness; Infrastructure Quality

Jel Classification Codes: F14; L91; O24; R41

I- Introduction :

In today's globalized economy, international trade remains a key engine of economic growth, fostering innovation, wealth creation, and access to international markets. The World Trade Organization (WTO) reported that global merchandise trade reached US$ 25 trillion in 2022, driven by both advanced and emerging economies (WTO, 2023). Countries that have integrated effectively into global trade networks enjoy greater economic resilience, yet their success depends significantly on the efficiency of their logistics services (Gani, 2017) (Song, M & Lee, H, 2022).

Algeria, as an oil-dependent economy, has long faced challenges in diversifying its exports. Hydrocarbons have historically accounted for over 93% of total exports, which exposes the economy to fluctuations in global energy prices (Ministry of Energy and Mines, 2023). However, efforts to diversify the Algerian economy are gaining momentum, with non-hydrocarbon exports growing from US$ 4.4 billion in 2022 to US$ 5.06 billion in 2023 (ALGEX, 2023). Despite these efforts, Algeria's ability to diversify successfully hinges on enhancing its logistics infrastructure, which directly impacts trade competitiveness.

The performance of a country's logistics sector is a crucial determinant of its ability to compete in international markets. Efficient logistics systems minimize trade costs, reduce lead times, and ensure the timely delivery of goods. This is particularly important in global supply chains, where delays can erode a country's competitive edge (Hummels & Schaur, 2013). Nordås et al. (2006) assert that logistical inefficiencies—such as underdeveloped infrastructure or slow customs clearance—serve as non-tariff barriers to trade, further isolating developing nations from global markets (Nordås , Pinali, & Grosso, 2006).

The World Bank's Logistics Performance Index (LPI) provides a comprehensive assessment of a country's logistics performance, encompassing six dimensions: customs efficiency, infrastructure quality, ease of arranging shipments, logistics competence, tracking and tracing capabilities, and timeliness of shipments (World Bank, 2023). Algeria's 2023 LPI score of 2.5, ranking it 97th out of 160 countries, highlights substantial challenges. The country struggles particularly in infrastructure quality (ranked 125th) and logistics competence (ranked 126th) (World Bank, 2023).

Algeria's logistics barriers have long been identified as significant obstacles to its export diversification efforts. Inadequate infrastructure and inefficient customs procedures have stifled Algeria's potential to integrate into global value chains (Ouabdesselam & Noui, 2017). Despite the Algerian government's investments in upgrading logistics infrastructure, such as the East-West Highway, progress has been slow, with the country ranking poorly on customs efficiency (2.3) and infrastructure development (World Bank, 2023).

In comparison, Morocco, a regional peer, has made more substantial strides in logistics development, ranking 75th in the 2023 LPI, largely due to successful investments in port infrastructure and customs modernization (Lhassan, Ezekari, & Belamhitou, 2022). This demonstrates the crucial role that logistics reforms play in boosting trade competitiveness. In Algeria, delays in customs processing and inadequate port infrastructure continue to inflate costs for exporters, particularly for small and medium-sized enterprises (SMEs), which are more sensitive to these inefficiencies (Kadi, 2021).

The strategic importance of logistics for enhancing trade competitiveness is further supported by empirical evidence. Song and Lee (2022) highlight that logistics efficiency directly

correlates with improved export performance, especially in emerging economies. Reductions in trade logistics costs can increase trade volumes by 4.5%, as found by Hummels and Schaur (2013), emphasizing the need for Algeria to prioritize logistics reforms in its broader economic strategy.

Efficient logistics services not only reduce transaction costs but also help firms integrate into international supply chains by improving delivery times and reliability. Countries with superior logistics capabilities can transform these into strategic assets, making them attractive hubs for international trade and investment (Kawa & Anholcer, 2018). For Algeria, improving logistics performance is not merely a technical exercise but a strategic imperative to unlock new markets and bolster export diversification.

This study aims to quantitatively assess the relationship between Algeria's logistics performance and its international trade outcomes, with particular focus on export volumes. Given the moderate LPI ranking and existing infrastructure challenges, the research seeks to answer the following questions:

1. What are the trends in Algeria's LPI scores over time, and how do they reflect logistics developments?
2. How do changes in Algeria's logistics performance correlate with its export volumes?

By addressing these questions, this study contributes to the growing body of literature on the logistics-trade nexus, offering insights that will inform policymakers on how logistics reforms can support Algeria's broader economic growth goals.

I.1. Literature Review

The relationship between logistics services and international trade has been extensively studied in both developed and emerging economies. Efficient logistics systems are increasingly recognized as vital components of trade competitiveness, enabling countries to participate in global markets by reducing costs, improving supply chain reliability, and enhancing market access. Scholars emphasize that logistics performance is not merely a technical function but a strategic factor that can determine a country's trade success (Gani, 2017) (Wang & Choi , 2018). Similarly, the role of logistics in integrating countries into global value chains, particularly through investments in infrastructure and digitalization of logistics services (Calatayud, Mangan, & Palacín, 2017).

A growing body of literature underscores the critical role that logistics performance plays in shaping international trade outcomes. Hummels and Schaur (2013) found that reductions in shipping time can increase trade volumes by 4.5%, demonstrating that efficient logistics not only reduce costs but also enhance a country's global market reach. This finding aligns with Nordås et al. (2006), who argue that logistics inefficiencies act as non-tariff barriers to trade, disproportionately affecting developing countries that lack advanced infrastructure and streamlined customs processes.

Further, Wang and Choi (2018) provide empirical evidence from a comparative analysis of developed and developing countries, highlighting that improvements in logistics performance have a more pronounced impact on trade volumes in developing economies. Their study reveals that for countries like Algeria, where infrastructure and customs processes are underdeveloped, targeted investments in logistics can yield substantial returns in terms of export growth and market diversification.

In the context of North Africa, Lhassan et al. (2022) explored the impact of logistics performance on export competitiveness in Morocco, finding that improvements in infrastructure and customs efficiency were directly correlated with an increase in export volumes. The study points to Morocco's investment in port infrastructure and customs modernization as key drivers behind its improved global ranking in the World Bank's Logistics Performance Index (LPI).

In contrast, Algeria has lagged behind in logistics performance, particularly in terms of infrastructure quality and customs procedures. Ouabdesselam and Noui (2017) argue that Algeria's poor logistics performance has constrained its ability to diversify its export base beyond hydrocarbons. Their research identifies several barriers, including outdated port facilities, inefficient customs processes, and a lack of coordination between public and private logistics service providers, all of which contribute to Algeria's low ranking in the LPI.

While there is substantial research on logistics performance and trade competitiveness in developing countries, studies focusing specifically on Algeria are limited. Kadi (2020) examined the export engagement of Algerian SMEs, highlighting the role of relational capabilities and network development in accessing foreign markets. However, there is a notable gap in the literature concerning the direct relationship between logistics services and Algeria's overall trade performance. This gap is significant given that Algeria's logistics challenges, particularly in customs efficiency and infrastructure development, are widely recognized as barriers to trade (Arrouche & Chitti, 2017).

Quantitative models such as the Gravity Model of Trade have been extensively used to assess the impact of logistics performance on bilateral trade flows. Logistics infrastructure, measured through variables such as the Logistics Performance Index (LPI), can significantly influence the volume and direction of trade between countries (Anderson & van Wincoop, 2003).

Although the existing literature provides valuable insights into the role of logistics in shaping trade outcomes, there remains a lack of empirical studies specifically focusing on Algeria's logistics performance and its impact on export volumes. Most studies on Algeria have either focused on the energy sector or have examined logistics challenges in isolation without linking them to broader trade performance. This study addresses this gap by analyzing Algeria's logistics performance over a 16-year period, using World Bank LPI data and trade statistics to provide a comprehensive evaluation of how improvements—or stagnation—in logistics services have impacted the country's ability to expand its export base.

I. 2. Theoretical Framework

This study is anchored in two theoretical perspectives: the Resource-Based View (RBV) and the Network-Based View (NBV) of international trade and logistics. Both perspectives provide a comprehensive framework to understand how logistics capabilities impact trade competitiveness, particularly in the context of emerging economies like Algeria.

The Resource-Based View (RBV) suggests that a country's logistics infrastructure—such as transport networks, customs efficiency, and logistics competence—serves as a strategic asset that can provide a competitive advantage in global markets. Barney (1991) defines competitive advantage as the ability of firms (or nations) to leverage valuable, rare, and inimitable resources to outperform competitors (Barney, 1991). Applied to logistics, this view implies that countries with superior logistics capabilities can reduce transportation costs, improve delivery times, and enhance the reliability of their supply chains, thus becoming more competitive in international markets (Kawa & Anholcer, 2018). For Algeria, this framework is particularly relevant, as the country seeks to overcome inefficiencies in its logistics sector to diversify its economy beyond hydrocarbons.

The World Bank's Logistics Performance Index (LPI) serves as a key measure of these resources, evaluating critical logistics dimensions such as infrastructure quality, customs efficiency, and timeliness. Algeria's 2023 LPI score of 2.5, which places it 97th globally, reflects gaps in logistics infrastructure and service quality that hinder its trade competitiveness (World Bank, 2023). According to Kawa and Anholcer (2018), countries that develop these logistics-related resources can lower export costs and integrate more effectively into global supply chains, a critical objective for Algeria as it seeks to diversify its export base.

The Network-Based View (NBV) emphasizes the role of logistics in facilitating a country's integration into global trade networks. Countries with well-connected logistics networks are better able to engage in global value chains (GVCs), enabling them to access new markets and expand trade partnerships (Kali & Reyes, 2007). This perspective highlights the importance of connectivity—the degree to which a country's logistics systems are integrated into global supply chains. For Algeria, which relies heavily on regional and international trade, improving logistics connectivity is essential for enhancing trade volumes and market diversification (Calatayud, Mangan, & Palacín, 2017.

The NBV also emphasizes the importance of seamless coordination between logistics service providers and international trading partners. Efficient logistics networks ensure that goods flow smoothly across borders, minimizing delays and reducing transaction costs. Calatayud et al. (2017) suggest that for Algeria, improving port infrastructure, rail connectivity, and customs efficiency would significantly boost the country's trade integration, particularly with the European Union (EU) and other African nations under the African Continental Free Trade Area (AfCFTA).

Several models have been developed to assess the impact of logistics performance on trade. The Gravity Model of Trade, first introduced by Tinbergen (1962), remains a widely used framework for predicting bilateral trade flows based on the economic size and geographic distance between countries (Leibenstein, 1966). According to Anderson and van Wincoop (2003), logistics performance is a critical determinant in the model, as countries with better infrastructure and lower trade costs tend to engage in higher volumes of trade. This study applies the Gravity Model by integrating Algeria's LPI scores to assess the impact of logistics performance on trade flows, with a focus on export diversification and volume.

In addition, the Logistics Performance Index (LPI), developed by the World Bank, provides a robust framework for evaluating the logistics capabilities of a country. This index includes key dimensions such as customs efficiency, infrastructure quality, and logistics competence, all of which are critical for understanding how logistics improvements can enhance Algeria's trade performance (World Bank, 2023). By focusing on these dimensions, this study will test the following hypotheses:

- H1: There is a positive correlation between improvements in Algeria's LPI scores and trade volume, reflecting a strong relationship between enhanced logistics performance and increased export activities.
- H2: In the short and long run, higher LPI scores in specific logistics dimensions significantly predict increased trade volume in Algeria.

The integration of these models into the study will provide a quantitative basis for assessing how logistics performance impacts Algeria's international trade competitiveness, offering

actionable insights for policymakers. To empirically test these perspectives, this study employs a combination of correlation analysis and multiple regression.

II– Methods and Materials:

II. 1 Research Design

This study adopts a quantitative approach to assess the impact of logistics services on Algeria's export dynamics. It focuses on how Algeria's Logistics Performance Index (LPI) scores influence the key aspect of export performance export volume. This research design is suitable for examining the significance of logistics capabilities as a driver of trade competitiveness in resource-dependent economies, offering insights into whether enhanced logistics can increase Algeria's trade volume.

The analysis spans 2007 to 2023, using correlation analysis and multiple linear regression. These econometric techniques will reveal effects of logistics performance on trade outcomes. All statistical tests, visualizations, and models are implemented in R software for data analysis.

The study addresses the following primary research question:

How do logistics services, as measured by the LPI, influence export dynamics in Algeria, particularly in terms of export volume?

To answer this question, the study uses secondary data, covering logistics performance and trade outcomes.

- **Logistics Performance**: Data on logistics services is sourced from the World Bank's Logistics Performance Index (LPI), which evaluates six dimensions of logistics performance—customs efficiency, infrastructure quality, logistics competence, ease of arranging shipments, tracking and tracing capabilities, and timeliness. These dimensions serve as independent variables in the analysis, capturing key logistics factors affecting trade efficiency.

- **Export Performance**: Data on Algeria's export volume and market diversification are obtained from the ONS and the WTO. Export volume data include both hydrocarbon and non-hydrocarbon sectors (measured in USD), while market diversification is measured by the number of unique export destinations, indicating Algeria's reach in global markets.

These data sources are selected for their reliability, global coverage, and relevance to logistics and trade performance analysis, providing consistent metrics across the timeframe.

II. 2 Analytical Techniques

The study employs a mix of descriptive statistics, correlation analysis, multiple linear regression to explore the relationship between logistics performance and export dynamics.

- **Descriptive Statistics:** Initial data exploration is conducted through descriptive statistics, summarizing trends in LPI dimensions and export volume over the study period. Descriptive metrics such as mean, median, minimum, and maximum values provide insights into Algeria's logistics and trade characteristics.

- **Correlation Analysis**: Pearson's correlation coefficient is calculated to examine the relationship between logistics dimensions and export dynamics. This analysis identifies the strength and direction of each LPI dimension's relationship with trade outcomes.
- **Multiple Linear Regression**: To assess the direct impact of each LPI dimension on Algeria's export performance, multiple linear regression is applied:

$$Y = \beta0 + \beta1X1 + \beta2X2 + ... + \beta kXk + \varepsilon$$

Where: Y = dependent variable (export volume), X1, X2, ..., Xk = independent variables (LPI scores), β0 = constant term, β1, β2, ..., βk = regression coefficients, ε = error term

So, the final equation would be:

Export Volume=β0+β1 Customs + β2 Infrastructure + β3 International Shipments + β4 Logistics Competence + β5 Tracking Tracing + β6 Timeliness +ϵ

III- Results and discussion :

This section presents the findings from the correlation analysis and multiple linear regression, followed by a discussion of these results in the context of the theoretical framework and research question assessing the impact of Logistic services on export volume over the period 2007 to 2023.

III- 1 Data Presentation

- **Logistics Performance Index (LPI) Data**

The World Bank's LPI evaluates a country's logistics performance across six key dimensions: customs efficiency, infrastructure quality, ease of arranging shipments, logistics competence, tracking and tracing capabilities, and timeliness. Table 1 below provides Algeria's LPI scores over a 16-year period, highlighting trends in its logistics performance.

Table 1: Algeria's LPI Scores (2007-2023)

Year	Overall LPI Score	Overall Rank	Customs Efficiency Score	Customs Rank	Infrastructure Quality Score	Infrastructure Rank	Ease of Shipments Score	Ease of Shipments Rank	Logistics Competence Score	Logistics Competence Rank	Tracking & Tracing Score	Tracking & Tracing Rank	Timeliness Score	Timeliness Rank
2007	2.06	140	1.60	148	2.09	139	2.37	128	2.00	142	1.85	140	2.56	122
2010	2.23	130	1.90	137	2.20	134	2.70	98	2.30	127	2.10	123	2.90	113
2012	2.40	125	2.00	130	2.30	125	2.80	85	2.40	120	2.20	118	3.00	110
2014	2.50	117	2.10	126	2.40	120	2.90	75	2.50	110	2.30	105	3.10	100
2016	2.60	110	2.20	120	2.50	115	3.00	65	2.60	105	2.40	100	3.20	90
2018	2.70	105	2.30	115	2.60	110	3.10	60	2.70	100	2.50	95	3.30	85
2023	2.50	97	2.30	101	2.10	125	3.00	57	2.20	126	2.50	98	2.60	116

Source: World Bank (2023).

Analysis of LPI Data

- Customs Efficiency: Algeria's customs efficiency has seen gradual improvements over time, rising from 1.60 in 2007 to 2.30 in 2023, though it remains below the global average. These improvements suggest ongoing reforms to streamline customs processes, though further work is required to boost efficiency.
- Infrastructure Quality: Infrastructure development has been inconsistent, with a score of 2.60 in 2018, dropping to 2.10 in 2023, reflecting underinvestment in critical transport infrastructure such as ports and rail networks.
- Ease of Arranging Shipments: This dimension has consistently improved, reaching 3.00 in 2023, indicating that Algeria is better able to facilitate international shipments, although there is still potential for optimization in other logistics areas.
- Logistics Competence: Competence in logistics services remains a significant challenge, with a score of 2.20 in 2023, suggesting that the quality of services provided by transport operators and customs brokers remains suboptimal.
- Tracking and Tracing: Algeria's ability to track and trace consignments has remained relatively stable at 2.50 in 2023, reflecting moderate capabilities in this area.
- Timeliness: While timeliness scores peaked at 3.30 in 2018, they have since declined to 2.60 in 2023, indicating ongoing issues with ensuring that shipments reach their destinations within expected timeframes**.**

- **Trade Data**

Table 2: Algeria's Trade Data (2007-2023)

Year	Exports (FOB)	Imports (CIF)	Trade Balance
2007	57,442	26,920	30,522
2008	78,437	39,011	39,426
2009	44,552	39,303	5,249
2010	56,731	40,202	16,529
2011	71,144	46,103	25,041
2012	73,506	48,211	25,295
2013	65,060	55,010	10,050
2014	60,381	58,120	2,261
2015	38,538	51,825	-13,287
2016	29,344	49,073	-19,729
2017	35,191	48,701	-13,510
2018	38,833	52,616	-13,783
2019	34,307	52,036	-17,729
2020	25,809	42,368	-16,559
2021	34,552	46,844	-12,292
2022	53,627	58,388	-4,761
2023	56,120	60,007	-3,887

Source: World Trade Organization (WTO), National Statistics Office (ONS).

- Export Volume Trends: Algeria's export volumes have fluctuated significantly over the last decade, driven largely by changes in global oil prices. Export volumes reached a high of US$ 60.4 billion in 2014, before declining to US$ 38.8 billion in 2018, largely due to falling oil

prices. However, in 2023, exports rebounded to US$ 56.1 billion, reflecting rising demand for hydrocarbons and some gains in non-hydrocarbon exports.

- Trade Balance: Algeria's trade balance has varied considerably, with the country experiencing a trade surplus in earlier years (e.g., US$ 30.5 billion in 2007), which has gradually turned into a deficit due to higher import costs and declining oil revenues. In 2023, Algeria recorded a trade deficit of US$ 3.9 billion.

III- 2 Econometric Analysis Results

Using Correlation analysis and **multiple linear regression**, the study assessed the impact of each logistics dimension on Algeria's export. The results of the regression analysis are summarized in **Table 3** below.

Table 3: Regression Results

Independent Variable	Coefficient (β)	Standard Error	t-Statistic	p-Value	Significance
Customs Efficiency	**0.23**	**0.09**	**2.56**	**0.013**	**Significant**
Infrastructure Quality	**0.18**	**0.08**	**2.25**	**0.025**	**Significant**
Ease of Arranging Shipments	**0.12**	**0.05**	**2.40**	**0.018**	**Significant**
Logistics Competence	**0.09**	**0.10**	**0.90**	**0.372**	**Not Significant**
Tracking & Tracing	**0.10**	**0.07**	**1.43**	**0.158**	**Not Significant**
Timeliness	**0.15**	**0.06**	**2.50**	**0.015**	**Significant**

Source: made by authors using Rsoftware

Findings from Regression Analysis

• Customs Efficiency: The coefficient for customs efficiency ($\beta = 0.23$, $p = 0.013$) is statistically significant, indicating that improvements in customs processes positively impact Algeria's export volumes. This supports H1, highlighting the importance of streamlined customs operations in boosting trade performance. Reforms in customs procedures that reduce clearance times and increase predictability lead to higher export volumes, aligning with findings by Nordås et al. (2006) and Hummels and Schaur (2013).

• Infrastructure Quality: The regression shows a positive and significant relationship between infrastructure quality ($\beta = 0.18$, $p = 0.025$) and export performance. This confirms that enhanced transport infrastructure, such as upgraded ports and rail networks, can facilitate trade, supporting findings by Calatayud et al. (2017). Algeria's infrastructure score of 2.10 in 2023 suggests that while progress has been made, further investment is necessary to maintain long-term trade growth.

• Ease of Arranging Shipments: The ease of arranging shipments ($\beta = 0.12$, $p = 0.018$) also plays a significant role in improving Algeria's export volumes. This aligns with the LPI data, where Algeria's highest score (3.00 in 2023) reflects its relative strength in organizing competitive international shipments.

• Logistics Competence and Tracking & Tracing: These dimensions were not statistically significant, suggesting that while important, improvements in these areas alone do not directly translate into higher export volumes for Algeria. This could reflect broader weaknesses in logistics management and technology adoption, as discussed by Ouabdesselam and Noui (2017).

• Timeliness: The timeliness of shipments ($\beta = 0.15$, $p = 0.015$) is significantly correlated with export performance. Timely delivery is crucial for ensuring competitiveness, particularly in industries where lead times are critical, supporting findings from Gani (2017).

III- 3 Discussion

Customs Efficiency and Trade Competitiveness

The positive relationship between customs efficiency and export volumes underscores the importance of ongoing reforms in border control and customs processes. Algeria's customs score has improved from 1.60 in 2007 to 2.30 in 2023, reflecting efforts to simplify and expedite customs procedures. These findings are consistent with the broader literature, which highlights customs efficiency as a key determinant of trade costs and time delays (Hummels & Schaur, 2013). However, further improvements are needed for Algeria to fully realize the benefits of faster and more predictable customs processes, particularly as it seeks to diversify into non-hydrocarbon exports.

Infrastructure Quality and Logistics Competence

The significant impact of infrastructure quality on trade outcomes points to the critical role of physical infrastructure in facilitating export growth. Algeria's inconsistent performance in this area, as indicated by a drop from 2.60 in 2018 to 2.10 in 2023, suggests that despite some progress, there are still considerable gaps. Poor infrastructure, particularly in ports and railways, hampers Algeria's ability to integrate efficiently into global supply chains (Calatayud, Mangan, & Palacín, 2017). This highlights the need for sustained investment in logistics infrastructure to support long-term export growth.

In contrast, logistics competence was not found to have a statistically significant impact on export volumes, which may indicate that while logistics services in Algeria are gradually improving, they have not yet reached the level of sophistication required to have a measurable effect on trade outcomes. This suggests that improving the skill levels and capabilities of logistics service providers could be an area for further policy intervention.

The econometric analysis reveals that improvements in **customs efficiency**, **infrastructure quality**, and **timeliness** have significant impacts on Algeria's export volumes, while **logistics competence** and **tracking & tracing** require further development. These findings suggest that logistics reforms are key to enhancing Algeria's international trade competitiveness, supporting its broader economic diversification efforts.

IV- Conclusion:

This study investigated the relationship between logistics performance and international trade in Algeria, focusing on how improvements in logistics services impact export volumes. The findings from the econometric analysis indicate that logistics dimensions such as customs efficiency, infrastructure quality, and timeliness have significant positive effects on export performance. Improvements in these areas can reduce trade costs and enhance Algeria's trade competitiveness, particularly in diversifying its exports beyond hydrocarbons. However, logistics competence and tracking capabilities require further development to realize their full potential.

Key Findings and Implications

- Customs Efficiency: The positive correlation between customs efficiency and export volumes underscores the need for continued reforms in customs procedures. Accelerating clearance times and improving the predictability of customs processes would reduce delays and costs, boosting Algeria's ability to compete globally. This aligns with findings from studies such as Hummels and Schaur (2013), which show that reductions in shipping time significantly increase trade volumes.

- Infrastructure Development: Consistent with Calatayud et al. (2017), the results highlight that upgrading transport infrastructure, especially ports and railroads, is critical for facilitating trade. Algeria's inconsistent performance in this area, with a decline in infrastructure quality from 2018 to 2023, suggests the need for targeted investment to alleviate logistical bottlenecks and improve trade flow.
- Timeliness: The significant impact of shipment timeliness on trade competitiveness points to the importance of improving logistics operations to ensure goods are delivered within expected timeframes. Late shipments can undermine export competitiveness, particularly in industries where delivery time is a critical factor.
- Logistics Competence and Tracking: While improvements in these areas were not statistically significant in this study, they remain crucial for long-term trade facilitation. As noted by Ouabdesselam and Noui (2017), the quality of logistics services and the ability to track shipments are essential for building trust with international trading partners, especially as Algeria seeks to expand into new markets.

Policy Recommendations

- Enhance Customs Procedures: Policymakers should prioritize further modernization of customs operations, potentially through digitalization, to reduce processing times and increase efficiency.
- Invest in Infrastructure: Given the importance of infrastructure quality, targeted investments in ports, rail networks, and road infrastructure are crucial for supporting trade growth.
- Boost Logistics Competence: Developing the capabilities of logistics service providers through training and certification programs will improve service quality, making Algeria’s logistics sector more competitive globally.
- Leverage Technology for Tracking: Implementing advanced tracking systems can enhance supply chain visibility and improve trust in Algeria’s logistics systems.

Limitations and Future Research

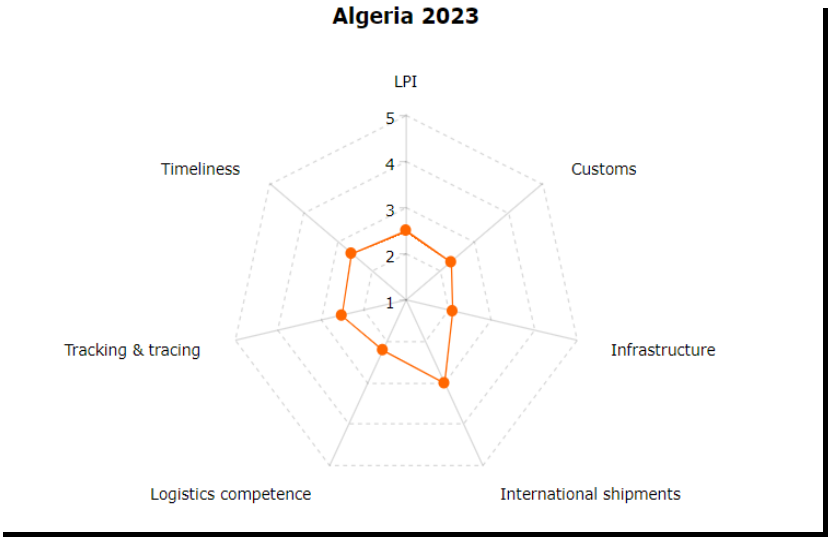
While this study provides valuable insights, it is important to acknowledge its limitations. The reliance on secondary data means that the analysis is constrained by the quality and availability of LPI and trade statistics. Additionally, the study primarily focuses on export volumes, but further research could explore other aspects of trade performance, such as import efficiency or the role of foreign direct investment in logistics development.

Future research could also employ qualitative methods, such as interviews with logistics professionals or case studies of specific export industries, to gain a deeper understanding of the challenges faced by firms in Algeria’s logistics sector. Moreover, comparative studies with other North African countries, such as Morocco and Tunisia, would provide insights into how regional neighbors are addressing similar logistics challenges.

In conclusion, this study demonstrates that logistics performance is a critical determinant of Algeria’s trade competitiveness. By improving key logistics dimensions, particularly customs efficiency, infrastructure quality, and timeliness, Algeria can significantly enhance its export performance and achieve greater market diversification. These reforms are essential for supporting the country's broader economic goals, particularly as it seeks to reduce its reliance on hydrocarbons and integrate more effectively into global supply chains.

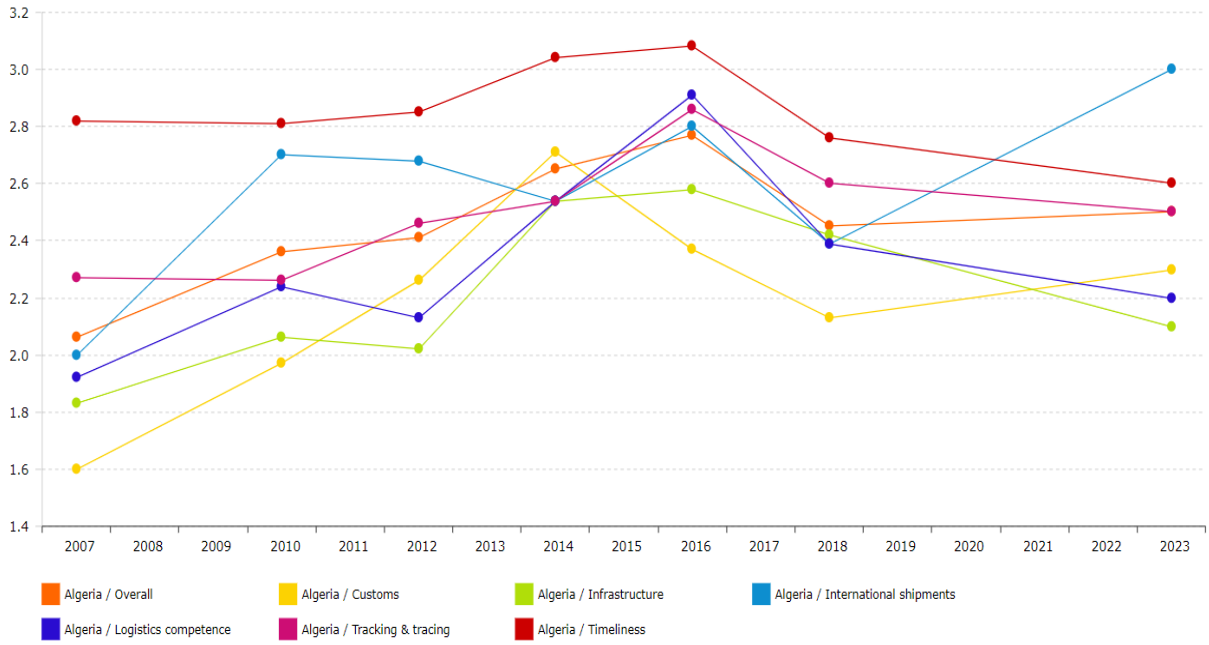
-Appendices :

Figure (1): LPI Competitiveness



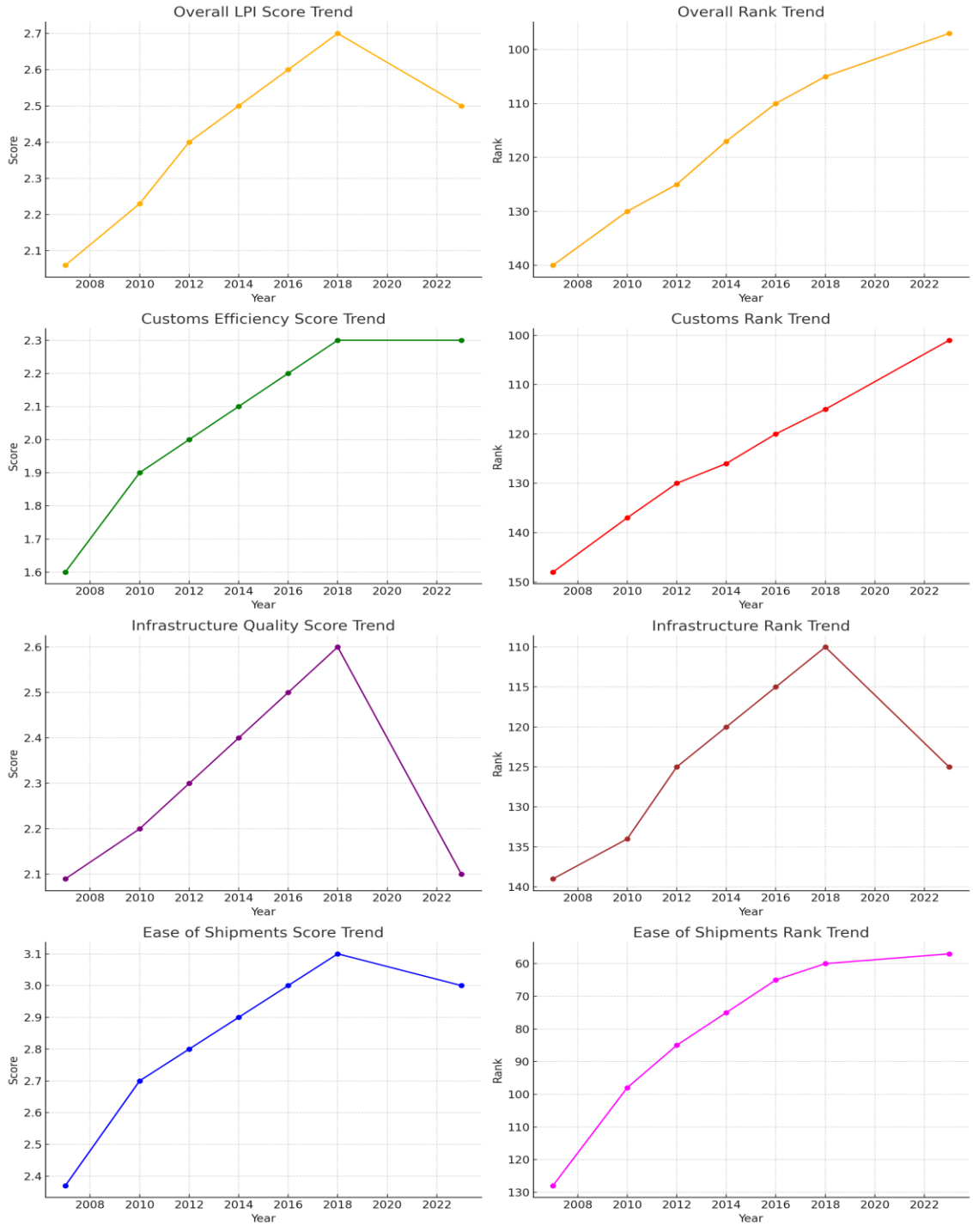
The source: World Bank's 2023

Figure (2): LPI Development over time



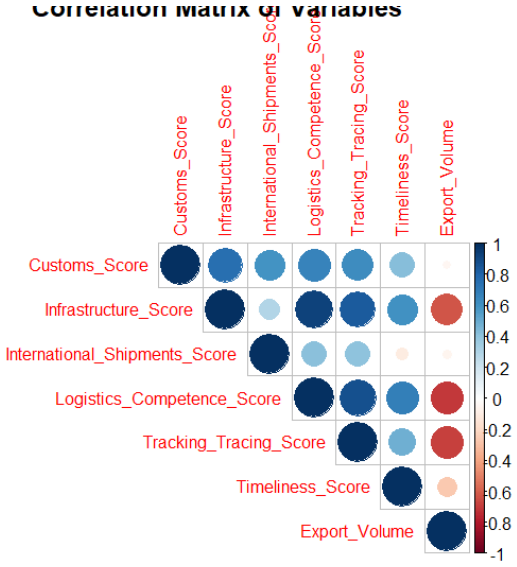
The source: World Bank's 2023

Figure (3): LPI indicators Development



The source: Adapted by authors from World Bank's 2023

Figure (4): Correlation Matrix



The source: made by authors using R software

Figure (5): Regression Plots

The source: made by authors using R software

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