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# Determinants of Outbound Logistics Performance in Selected Sub-Saharan Africa Countries: A Panel Data Analysis

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## Abstract

***Purpose**: This study investigates the key determinants of outbound logistics performance in 22 Sub-Saharan African countries from 2010 to 2018. The aim is to identify how specific logistics-related factors affect overall supply chain efficiency in this region, characterized by diverse economic conditions and infrastructure challenges.*

***Design/methodology/approach:** A panel data approach with fixed effects modeling was employed to analyze the influence of factors such as consignment tracking and tracing, logistics competency, customs clearance processes, and timely delivery of consignments on logistics performance. The research focuses on understanding how these variables interact over time and across countries.*

***Findings/results:** The analysis reveals that timely delivery of consignments significantly enhances logistics performance, while customs clearance processes negatively impact it. Logistics competency has a marginally positive effect on performance. These results highlight the varying influence of each factor and the importance of considering country-specific conditions and time-specific variations in logistics performance analysis.*

***Practical implications:** The findings have significant implications for policymakers and businesses. Policymakers are encouraged to prioritize improvements in consignment tracking and streamline customs procedures. For businesses, understanding the key determinants of logistics performance can inform strategic investments in logistics infrastructure and operational processes, ultimately enhancing overall supply chain efficiency in the region.*

***Originality/value:** This paper contributes to the existing literature by offering insights into the unique logistics challenges faced by Sub-Saharan African countries. It provides a comprehensive analysis using a robust panel data approach, offering valuable information for decision-makers and stakeholders interested in improving outbound logistics performance in the region.*

***Keywords:** Outbound logistics performance, Sub-Saharan Africa logistics, Supply chain efficiency, Panel data analysis in logistics, Customs clearance and logistics, Consignment tracking and tracing, Logistics competency and performance, Fixed effects modeling in supply chains.*

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# Introduction

Efficient outbound logistics is a cornerstone of effective supply chain management and is critical for economic development, particularly in regions with complex economic and infrastructure landscapes like Sub-Saharan Africa (SSA). As supply chains become increasingly intricate, the efficiency of outbound logistics, which involves the distribution of goods from production facilities to end-users, becomes pivotal for ensuring timely delivery and enhancing overall economic performance (Richey et al., 2022).

Outbound logistics directly influences a company ability to meet customer expectations and maintain competitive advantage. Effective logistics strategies not only ensure the smooth movement of goods but also manage information flow and coordination across various logistics activities (Ongati & Aila, 2023). This is crucial for improving customer service and business productivity by ensuring that products are delivered in a timely and reliable manner (Klumpp & Heragu, 2019).

In SSA, outbound logistics is particularly significant due to its role in facilitating trade, regional connectivity, and economic growth (Adeyinka, 2023). SSA's diverse economic conditions and infrastructural challenges highlight the need to comprehensively understand how logistics performance varies across different regional contexts. The strategic importance of SSA as a growing trading bloc underscores the necessity of addressing the specific logistics challenges it faces (Adewole & John, 2019).

Despite extensive research on logistics performance in SSA, there is a notable gap in studies utilizing panel data approaches to explore outbound logistics. Previous research has primarily focused on cross-sectional analyses or broader logistics performance metrics, with limited attention to how time-bound and country-specific factors influence outbound logistics (Bakar et al., 2016; Muazu, 2019; Wang et al., 2022). This study aims to fill this gap by employing panel data analysis to investigate the determinants of outbound logistics performance, considering variables such as consignment tracking, customs clearance, and timely delivery.

By addressing this gap, the research provides new insights into how various factors impact logistics performance across SSA countries over time. The findings offer valuable information for policymakers and businesses to enhance logistics strategies, improve infrastructure, and streamline processes, ultimately contributing to better supply chain efficiency and regional economic development.

In conclusion, this study aims to identify and analyze key determinants of outbound logistics performance in SSA using panel data analysis. It seeks to contribute to a deeper understanding of how specific logistics-related factors impact supply chain efficiency in the region, addressing both temporal and spatial variations.

# Literature Review

## *Theoretical Perspectives on Outbound Logistics Performance*

Despite notable advancements in recent decades, SSA faces varied economic conditions and widespread infrastructural challenges that define numerous regions across the continent (Juju et al., 2020). These conditions and challenges differ between countries and change over time, adversely affecting the reliability and efficiency of outbound logistics. Addressing these issues is crucial to minimizing costs, reducing lead times, and improving overall customer satisfaction (Momin & Parmar, 2024). The SSA Regional Economic Outlook (IMF, 2023) highlights the variability in diverse economic conditions, including funding squeeze, inflation, exchange rate pressure, longer-term prosperity, and political stability across SSA countries. Meanwhile, transport in SSA has been associated with a host of infrastructural network challenges such as poor inland road quality, slow development in transportation technology, inadequate rail capacity, and bottle-necked port operations which contribute significantly to the high costs of transportation (Hanif & Kaluwa, 2016). Given the challenges, there is an opportunity to address these issues through more balanced and sustainable strategic investments, particularly by strengthening the existing secondary transport networks that converge into urban centers (Josa & Magrinya, 2018). For example, previous concerns have focused on why cargo remains in SSA ports for weeks (Raballand et al., 2012).

Notwithstanding, the diversity in economic conditions and infrastructural challenges witnessed across SSA countries over time, existing research focuses mostly on cross-sectional studies targeting the broad

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perspective of logistic performance (Bakar et al., 2016; Gacuru & Kabare, 2015; Muazu, 2019; Wang et al., 2018; Wang et al., 2022), leaving gaps on what factors would best explain outbound logistics performance, and the role country-specific and time-bound variations would play. Notably, no studies have used the panel data analysis approach that would exhaustively probe the contributions of temporal and cross-sectional variations in outbound logistics performance.

Several studies have endeavored to shed light on logistics performance in SSA, focusing particularly on the challenges in road freight transport. Key issues include overloaded and under-utilized vehicles, outdated fleet, delays at transit points, inadequately trained personnel, and poor road infrastructure. Burl (2019) highlights the potential of inter-modal containerization as a solution, standardizing freight units to improve vehicle utilization and prevent overloading. This approach not only addresses logistical inefficiencies but also aims to mitigate pricing disparities through transparent tariff structures. Moreover, while investments in road infrastructure are costly and time-consuming, advancements in vehicle technology offer a more immediate and economically viable solution to enhance transport efficiency across the region.

The study by Al Abbadi et al. (2021) focuses on assessing the challenges and opportunities in optimizing logistics and supply chain performance in Oman. Recognizing the sector pivotal role in Oman Vision 2040's economic diversification goals, the study confirmed the proposed relationships in their model through hypothesis testing, highlighting significant findings that contribute academically, empirically to companies and communities, and managerially to the literature on logistics and supply chain management in Oman, thereby supporting economic diversification efforts.

The study by Muogboh and Ojadi (2018) explores indigenous logistics and supply chain management (SCM) practices in Africa, emphasizing the continent dual role as a major supplier of commodities and a significant consumer market. The authors conduct a comprehensive review to contextualize logistics practices in SSA, highlighting historical, cultural, and contextual factors that shape these practices. They conduct a comparative analysis of logistic performance across various African countries, identifying both challenges and opportunities inherent in the African logistics landscape. Their study aims to provide strategic insights for organizations operating in or dealing with Africa, suggesting practical recommendations to optimize logistics operations and leverage opportunities in the region.

Adewole (2019) conducts a descriptive study to analyze the state of logistics infrastructure in Africa and its impact on trade and economic development. The research highlights several critical issues hindering infrastructure development, including inadequate facilities, lack of a unified regulatory framework across the continent, political challenges, and limited technological application. These factors collectively impede the efficient functioning of logistics and supply chains in Africa. The study concludes by advocating for the improvement of freight transport facilities and the implementation of regulatory reforms as crucial steps towards enhancing logistical infrastructure in the region, thereby facilitating economic growth, and fostering smoother business operations.

Choy and Kamoche (2022) investigate the factors influencing the recommendation of Kenya travel products by Hong Kong travel agencies using an exploratory sequential mixed method approach. Initially, 32 in-depth interviews are conducted with outbound travel practitioners to gather qualitative insights. From these interviews, 39 attributes influencing recommendations are identified. Subsequently, a tailored questionnaire is developed and administered to 239 travel agency practitioners. Through an importance-performance analysis focusing on six key factors-Catering and Ancillary Services, Shopping, Tourist Transport Provision and Infrastructure, Hotel Accommodation, Institutional Support, and Destination Image – the study finds that improving Tourist Transport Provision and Infrastructure should be prioritized, especially in resource-constrained settings. This research lays groundwork for further exploration into strategic tourism marketing and management, particularly in the Asia–Africa context, which remains relatively under researched.

On the other hand, the study by Munim and Schramm (2018) investigates the economic impacts of port infrastructure and logistics performance on economic growth, emphasizing the mediating role of seaborne trade. Conducted across 91 countries with seaports, the research employs a structural equation model (SEM) to empirically analyze the relationships. The findings underscore the significant economic benefits derived from enhancing port infrastructure quality, which facilitates improved logistics performance. This, in turn, amplifies seaborne trade and subsequently

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boosts economic growth. Importantly, the study highlights that while developing countries stand to gain substantially from such improvements, the economic benefits diminish as these countries progress economically.

Furthermore, Shikur (2022) investigates the impact of logistics performance dimensions on international trade in developing countries, employing pooled random-effects General Least Square (GLS) regression. Emphasizing transaction cost economics (TCE) as a conceptual framework, the research underscores logistics technologies role in enhancing efficiency, managing goods movement, and improving supply chain visibility. By analyzing data sourced from the World Bank, the study categorizes developing countries into African nations and others, comparing logistics performance dimensions through Independent T-Tests. The findings reveal that African countries generally exhibit lower logistics performance compared to their counterparts. Importantly, all six dimensions of logistics performance tracking and tracing, logistics quality, international shipments, customs clearance, timeliness, and infrastructure significantly influence both merchandized exports and imports. The study recommends ongoing enhancements in logistics service quality, shipment processes, tracking, timeliness, customs procedures, and infrastructure as pivotal strategies to augment trade volumes of goods and services internationally.

Although these previous studies provide insights into several elements of logistics in SSA, a significant gap remains in terms of panel studies that focus on outbound logistics, and account for time-bound and country-specific variations in outbound logistics performance in the region. This study seeks to employ the panel data analysis method to establish whether shipment monitoring, customs clearance, prompt shipment delivery, and infrastructure quality are significant determinants of outbound logistics. In employing a panel data approach, this research explores determinants of outbound logistics, accounting for temporal and spatial variations. The findings of this study inform targeted strategies for improving the performance of outbound logistics in SSA taking cognizance of variability across countries and with time.

## Theories on Outbound Logistics

### *Overview of Outbound Logistics Theories*

Outbound logistics encompasses the processes involved in storing, transporting, and delivering goods to customers along the value chain (Klumpp & Heragu, 2019). Outbound logistics performance is critical for supply chain efficiency and customer satisfaction, significantly impacting economic development through effective logistics integration, particularly in regions with substantial logistical challenges like SSA (Zacharias & Boopathy, 2022). Several theories and models provide frameworks to understand and improve outbound logistics performance. This review covers key logistics/supply chain theories relevant to outbound logistics: Resource-Based View (RBV), Transaction Cost Economics (TCE), Institutional Theory, and the Network Theory. Each theory is anchored to the variables under investigation; consignment tracking and tracing, logistics competence, customs clearance processes, and timely delivery of consignments and includes the proponent, proposition, limitations, and relevance of the theory. Understanding and applying these logistics and supply chain theories provide a comprehensive robust theoretical foundation for improving outbound logistics performance in SSA. Future research should continue to explore these relationships using advanced econometric techniques to further substantiate these findings over time.

## Theories and Their Relevance to Outbound Logistics Performance

### *Resource-based view (RBV):*

The Resource-Based View (RBV), advocated by Barney (1991) asserts that the internal resources and capabilities of a firm are critical determinants of its competitive advantage that assumes that resources are heterogeneously distributed among firms and that these resources are imperfectly mobile, making them difficult to replicate. The theory may not fully account for external factors such as regulatory changes and infrastructural challenges that can affect resource utilization. It also focuses predominantly on internal capabilities, potentially underestimating the influence of external collaboration. In the context of outbound logistics, resources such as advanced tracking systems, skilled logistics personnel, and efficient processes are key to enhancing performance (Kalubanga & Namagembe, 2022). Effective consignment tracking and tracing systems, for example, provide real-time visibility, reduce the risk of delays, and improve delivery reliability, which are valuable resources under the RBV framework.

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## Transaction cost economics (TCE):

Williamson (1981) is a key proponent of Transaction Cost Economics (TCE) which highlights the importance of minimizing transaction costs in achieving efficient supply chain operations. TCE assumes that transaction costs vary depending on the complexity and uncertainty of exchanges. It also assumes bounded rationality and opportunism among transaction parties. TCE may oversimplify the complexity of logistics operations by focusing primarily on cost reduction. It also assumes that transaction costs are always quantifiable and neglects non-economic factors such as trust and cultural differences. In outbound logistics, transaction costs can arise from delays at customs, inefficient tracking systems, and poor logistics competence. By improving customs clearance processes and ensuring timely delivery of consignments, firms can reduce these transaction costs, leading to enhanced logistics performance (Mutuku, 2021).

## Institutional Theory:

Institutional Theory, popularized by DiMaggio and Powell (1983), suggests that organizations conform to institutional pressures to gain legitimacy. The theory assumes that institutions exert coercive, mimetic, and normative pressures on organizations. It also assumes that compliance with institutional norms leads to organizational success and survival. Institutional Theory may not fully account for the strategic agency of firms in shaping their institutional environment. It also tends to focus more on conformity than on innovation and change. In the context of logistics, adherence to industry standards, regulatory requirements, and best practices in logistics operations are driven by institutional pressures. Enhancing logistics competence through the adoption of standardized practices and improving customs clearance processes in line with regulatory frameworks can significantly improve outbound logistics performance (Mengesha, 2020).

## Network Theory:

Network Theory advanced by scholars such as Håkansson and Snehota (1995) emphasizes the importance of relationships and information flow within a network. Network Theory assumes that the quality of relationships and the strength of ties between firms influence the flow of resources and information. It also assumes that networks evolve over time based on interactions and mutual dependencies. The theory may not adequately address power imbalances within networks or the impact of external disruptions. It also assumes that all firms have equal access to network benefits, which may not be the case. Effective outbound logistics relies on robust communication and coordination among supply chain partners. Implementing advanced tracking and tracing systems facilitates real-time information sharing, while strong relationships and trust within the logistics network ensure timely delivery of consignments, enhancing overall performance (Bolte & Goll, 2020).

## The Concept of Logistics

The Corporate Finance Institute (CFI) defines logistics as a process that involves diverse tasks and activities to systematically coordinate an entity supply chain operations (CFI team, n.d.). Jenkins (2023) recognizes logistics as the foundation of the supply chain through the coordination of the storage and movement of resources such as equipment, goods, and inventory. Jenkins argues that well-organized logistics potentially reduces expenses, enhance brand reputation, save time, and aid in meeting customer demands. According to the Indeed Editorial team, logistics is vital in the overall management of an organization supply chain, enabling the realization of clients' and customer's needs (Indeed Editorial Team, 2022).

In International trade relations, logistics alongside transportation have increasingly become pivotal. Research highlights the positive correlation between fluctuations in logistical performance and changes in international trade volumes (Beysenbaer, 2018; Gani, 2017). Moreover, research on production cost and logistics performance identifies spatial variations between countries as a critical factor contributing to trade friction (YIP, 2012). Dusko and Bozica (2016) have also pointed out that the interdependence between logistics processes and international trade has potential to impact trade dynamics over time, justifying conducting of longitudinal studies.

Outbound logistics is a process that involves storing, transporting, and delivering goods to customers using elements such as order management, inventory management, packaging procedures, and distribution networks (Shannon, 2022). The performance of outbound logistics is identified as a crucial factor in influencing the retailer's decisions to stock supplier's products as exemplified by leading retailers such as

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Target and Walmart through their stringent delivery standards on their suppliers (Miller & Liberatore, 2015). Miller and Liberatore argue that achieving optimal profits through outbound logistics is a function of the right strategy. Therefore, understanding suitable outbound logistics performance determinants is one avenue to the right strategy.

Several empirical studies have explored the potential impacts of logistics performance methods but have not exhaustively analyzed the direct influence of these metrics on outbound logistics performance across countries and with time. For instance, Bolte and Goll (2020) use the case of a Swedish retailer to explore track and trace systems in outbound logistics. Although the qualitative results highlight challenges in the effectiveness of existing track and trace technologies for outbound logistics, they did not account for the dynamic nature of tracking solutions implementation and heterogeneity across companies. Panel data analysis would have allowed consideration of cross-sectional and time series variations, capturing heterogeneity across companies and transformations of outbound logistic challenges over time.

In another study conducted by a Finnish Company, Shamsuzzoha et al. (2021) examine the tracking and tracing of a global supply chain network. They conclude that shipment tracking is gaining popularity within the supply and delivery network. Besides, they note that appropriate cost-effective tracking devices are critical in today's supply chain risk management. However, the analysis of present and past literature on supply chain tracking and tracing systems does not show how these systems impact outbound logistics performance. Additionally, evidence from a cross-sectional study conducted in the Finnish Context may not have provided long-lasting solutions appropriate for the diversity of SSA countries requiring a panel data analysis of determinants of outbound logistic performance in the region.

From SSA, Kalubanga and Namagembe (2022) examine the role logistics competence measured via outsourcing relationship quality, trust commitment plays in the logistics performance of selected manufacturing firms in Uganda. They determine that there is an indirect effect of trust on logistics performance through commitment, and logistics outsourcing relationship quality (LORQ). Although this study by Kalubanga and Namagembe showcases the critical role of logistics competence in logistics performance, the PLS-SEM approach used does not account for changes over time, emerging trends, and the variation of logistics competence within and between the diverse SSA countries.

Mutuku (2021) probes the effect of logistics and competence on competitive advantage among Kenyan importers engaged in durable consumer goods from Brazil. Using the ordinary least squares (OLS) regression, Mutuku determines that custom optimization, timelines, shipment, and infrastructure are significant determinants of competitive advantage. While the study contributes to highlighting potential determinants of outbound logistics performance, the correlational research design employed could not infer causality. Moreover, OLS regression does not cater to temporal dynamics and cross-country comparisons that could identify common trends and variations.

The study on the Effectiveness of Logistics Services on Firms' Performances – A Literature Review by Zadajali and Ullah (2024) investigates the evolving significance of logistics within supply chains, shifting from a cost-centric view to a critical strategic asset. The researchers conduct a qualitative study by extensively reviewing existing literature to elucidate the components and factors influencing logistics service performance, as well as its impact on overall company performance. Key findings emphasize the necessity for logistics service providers to invest in advanced practices and customer collaborations to adapt to evolving market demands effectively. The study underscores the complex nature of logistics effectiveness, advocating ongoing research to refine strategies and enhance competitiveness in logistics operations.

Assefa et al. (2022) use the Ethiopian Modjo Dry Port context to assess factors driving logistics operations. Using frequency distributions, they identify timeliness, port infrastructure, customs operations, and service quality as critical factors in the performance of the port. In doing so, they unearthed factors that need focus to optimize logistics performance. However, their use of frequency distribution raises concerns about inferring causality and limited statistical rigor. Although frequency distributions highlight associations between variables, they do not identify underlying causal mechanisms. Besides, they do not provide measures of statistical significance or confidence intervals limiting the assessment of the reliability of the results.

## Study Hypotheses

Most reviewed studies have examined determinants

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of logistics performance. Yet little or no study has addressed factors that directly impact outbound logistics performance. Therefore, this study conceptualizes that outbound logistics is a function of several determinants underscored in the following hypothesis.

***$H_a$1: Consignment tracking and tracing is a significant determinant of outbound logistics performance***

This hypothesis is derived from the literature showing that the ability to track and trace consignments not only allows companies to determine the physical location and status of goods in the supply chain but is also a reflection of a country capability to provide visibility and real-time tracking of shipment (Abivin, 2021; WorldRef Insights, 2023). The question is to verify the significant effect of tracking and tracing on outbound logistics across SSA countries in given years. The causal effect of tracking and tracing is found by using a bi-annual variation of ability to track and trace consignments within the country by imposing the assumption that tracking and tracing has only a long-term impact on outbound logistics performance in the long run. However, by controlling the time trend, the assumption is that tracking and tracing does not affect the bi-annual variation of outbound logistics performance. This assumption eliminates the simultaneous relation between tracking and tracing and outbound logistics performance in the short-term, allowing an interpretation of the co-efficient of tracking and tracing as the effect of tracking and tracing on outbound logistics performance.

***Ha2: Logistics competence is a significant determinant of outbound logistics performance***

This hypothesis is followed by empirical evidence showing that competence and quality of logistics services are central to logistics performance (World Bank, 2023, WorldInsights, 2023). With the variation of logistics competence within countries, over time, the aim was to determine the short-term causal effect of logistics competence on outbound logistics performance. Logistics competence can affect outbound logistics performance in the long run by optimizing processes, leveraging technology, and fostering strong relationships. However, by controlling the time trend, the presupposition was that the bi-annual variation in outbound logistics performance was not affected by logistics competence in the short term. Under this setup, the effect of logistics competence on outbound logistics performance was interpreted as causal.

***Ha3: The customs clearance process is a significant determinant of outbound logistics performance***

This hypothesis extended the first two hypotheses by seeking to add to determinants of outbound logistics performance. Much literature has documented the capability of customs clearance to positively influence logistics performance (Mengesha, 2020; Mutuku 2021). Bi-annual variation of customs clearance within the country is used by imposing an assumption that customs clearance has a short-term causal effect on outbound logistics performance. Besides, by controlling the time trend, the coefficient of the customs clearance process is interpreted as the effect of customs clearance on outbound logistics performance. Also, as a sensitivity check, the covariate for infrastructure is used to break its potential influence on the customs clearance process. In this way, the effects of the customs clearance process are interpreted as causal.

***Ha4: Timely delivery of consignment is a significant determinant of outbound logistics performance***

This hypothesis is a consequence of the empirical evidence showing that the reliability and speed of logistics services such as adherence to schedules, timeliness in deliveries, and transit times are likely to improve logistics performance (World Bank, 2023, WorldInsights, 2023). With the variation of timely delivery of consignment within countries, over time, the aim is to determine the short-term causal effect of timely delivery of consignment. Timely delivery of consignments can affect outbound logistics performance in the long. However, by controlling the time trend, the presupposition is that the bi-annual variation in outbound logistics performance is not affected by the timely delivery of consignment in the short term. Therefore, the effect of timely delivery of consignments on outbound logistics performance is interpreted as causal.

Table 1 provides a comprehensive summary of previous studies related to outbound logistics performance in SSA. It includes the objectives, sample or country of study, and the methodologies used in each research. The table also highlights the key contributions of each study, which range from examining infrastructural challenges and economic conditions to exploring specific logistics practices and technological advancements. The purpose of this table is to give readers an overview of the existing literature and identify gaps that the current research aims to address.

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# Methodology

This study employs a panel data approach to analyze outbound logistics performance across 22 SSA countries from 2010 to 2018. A panel dataset, also known as a longitudinal dataset, consists of repeated observations of the same entities over time. This methodology facilitates the examination of both cross-sectional and time-series effects, enhancing the robustness of the analysis (Clower, 2021).

## Data Collection

The dataset includes bi-annual observations for each of the 22 SSA countries within the study period. The overall logistics performance index rated from 1-low, to 5-high, is used to measure outbound logistics performance which in this case is the dependent variable. For the independent variables, logistics performance index (Ability to track and trace consignment, 1-low, 5-high; logistics performance index (competence and quality of logistics services, 1-low, 5-high); and logistics performance index (efficiency of customs clearance process; 1-low, 5-high) are used. Data are sourced from the World Bank Data Bank (2023) and focus on the World Development Indicators database. The criterion for selecting the 22 SSA countries is the availability of data on the variables for the entire study period (2010-2018). Data are analyzed using the Stata software (Version Stata/IC 15.0).

## Analytical Methods

To analyze the data, three-panel data models are considered:

*Pooled Ordinary Least Squares (OLS) Estimator*

The Pooled OLS model is specified as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it} \quad \text{..... eqn.1}$$

Where the model error term $\varepsilon_{it}$ is an idiosyncratic error for each country at a specific year. This approach assumes that the error term is independent, identically distributed (i.i.d.), and strictly exogenous. Under this assumption, the error is unrelated to any of the regressors and not correlated within and across countries given covariates. If the assumption holds, the $\beta_0$ and $\beta_1$ are estimated consistently. However, this assumption is quite restrictive and not realistic.

## Random Effect (RE) Estimator

The Random Effects model is specified as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + U_{it} \quad \text{.....eqn.2}$$

The $\alpha_i$ *is a country-specific error, and* $U_{it}$ is an idiosyncratic error. The RE requires $\alpha_i + U_{it}$ not to be related to any of the regressors. However, it allows $\alpha_i + U_{it}$ to be serially correlated within the country through $\alpha_i$. So, the variance of the error term can be heterogeneous across countries. If $\alpha_i + U_{it}$ is not related to any of the regressors, the coefficients $\beta_0$ and $\beta_1$ are estimated consistently, similarly to the Pooled OLS, but its standard error (SE) can be different due to $\alpha_i$ in the error term.

## Fixed Effects (FE) Estimator

The third estimate approach is the Fixed Effects (FE) estimator, the least restrictive estimator, allowing the $\alpha_i$ to be arbitrarily correlated to any regressors. It is applied to equation 3.

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \alpha_i + \vartheta_t + U_{it} \quad \text{..... eqn. 3}$$

Where $\alpha_i$ is the country-specific fixed effects, $\vartheta_t$ is the time-fixed effects, and $U_{it}$ is the idiosyncratic error. Even if there is an unobserved endogenous term in the model, the FE can estimate $\beta_0$ and $\beta_1$ consistently without any instrumental variables, so long as the endogenous term is time constant. Because, for the FE estimator, the time-constant endogenous term will be eliminated by timewise first-differencing. This is the main advantage of the FE against the Pooled OLS and RE estimator. However, the FE is known to be less efficient than the other two because it uses countries variation of regressors, while Pooled OLS and RE use a full variation, so there is a loss in available information.

The data used in this study was drawn from 22 SSA countries bi-annually from 2010 to 2018 (inclusive).

## Model Specifications

The study considered the fixed effects estimator specified in Equation 4

$$OLP_{it} = \beta_1 TT_{it} + \beta_2 LC_{it} + \beta_3 CCP_{it} + \beta_4 TDC_{it} + \alpha_i + \vartheta_t + U_{it} \quad \text{..... (eqn 4)}$$

Where OLP designated outbound logistics performance, TT tracking, and tracing, LC logistics competence, CCP customs clearance process, and

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TDC timely delivery of the consignment, $\alpha_i$ is the country-specific fixed effects, $\vartheta_t$ is the time fixed effects, and $U_{it}$ is the idiosyncratic error. This model allows the simultaneous variability in two types of unobserved fixed effects, country-specific factors such as diverse cultural habits, lifestyles, and geographical conditions, and time-specific factors such as natural disasters, and economic shocks.

### Data Analysis

The data analysis is conducted using Stata software (Version Stata/IC 15.0). The Fixed Effects estimator is chosen due to its ability to handle unobserved heterogeneity and its effectiveness in estimating coefficients consistently in the presence of time-invariant endogenous variables.

## Results and Discussion

Table 1 presents a comparative analysis of empirical findings on key factors influencing outbound logistics performance, juxtaposed against previous research outcomes. Consignment tracking and tracing technologies, as indicated by Abivin (2021) and *World Insights* (2023), affirm a significant positive impact on logistics efficiency. This aligns with earlier studies that underscore the benefits of real-time visibility and reduced delays in enhancing overall logistics performance.

Regarding logistics competence, findings from the World Bank (2023) and *World Insights* (2023) show a marginally positive effect. This contrasts with previous research emphasizing its pivotal role in logistics operations. The nuanced impact suggests that while competence remains critical, its effectiveness may vary across different contexts or be moderated by other factors not explicitly accounted for in the study.

In terms of customs clearance processes, Mengesha (2020) and Mutuku (2021) identify a significant negative impact on logistics performance, contrary to previous assertions of its positive influence. This discrepancy highlights regional inefficiencies or bureaucratic hurdles that impede smooth logistical operations, signaling a pressing need for targeted reforms to streamline customs procedures.

Lastly, timely delivery of consignments, according to the World Bank (2023) and World Insights (2023), exhibits a significant positive impact on logistics performance, consistent with prior expectations. The study reinforces the criticality of adherence to schedules and minimizing transit times to optimize logistics efficiency.

Table 1 compares the empirical results from the current study with those from previous research. It includes factors such as consignment tracking and tracing, logistics competence, customs clearance processes, and timely delivery of consignments. Table 1 contrasts the empirical results with prior research outcomes and provides conclusions regarding the consistency or divergence between the study findings and the existing literature. This comparison helps contextualize the study results within the broader research landscape and highlights areas where findings are either corroborated or challenged by previous work.

Table 1: Comparison of empirical results with previous research outcomes

| Factor | Current Study Findings | Previous Research Findings | Comparison and Conclusion |
|---|---|---|---|
| Consignment Tracking and Tracing | Significant positive impact on logistics efficiency (Abivin, 2021; WorldRef Insights, 2023) | Real-time visibility and reduced delays enhance logistics performance | Consistent with earlier studies. Emphasizes the importance of real-time tracking for improved logistics efficiency. |
| Logistics Competence | Marginally positive effect (World Bank, 2023; World Insights, 2023) | Critical role in logistics operations emphasized in earlier research | Contrasts with previous research. Effectiveness may vary based on context or unaccounted moderating factors. |
| Customs Clearance Processes | Significant negative impact on logistics performance (Mengesha, 2020; Mutuku, 2021) | Positive influence on logistics performance previously asserted | Discrepancy noted. Indicates regional inefficiencies or bureaucratic hurdles affecting logistics operations. |
| Timely Delivery of Consignments | Significant positive impact on logistics performance (World Bank, 2023; World Insights, 2023) | Consistent with prior expectations for adherence to schedules and minimized transit times | Consistent with earlier findings. Reinforces the importance of timely delivery for optimizing logistics efficiency. |

Source: Abivin (2021); World Insights (2023); World Bank (2023); World Insights (2023); Mengesha (2020); Mutuku (2021).

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## Descriptive Statistics

Descriptive statistics for the study variables are presented in Table 2. Table 2 summarizes key metrics for consignment tracking and tracing, logistics competency, customs clearance processes, timely delivery of consignment, and overall outbound logistics performance. Descriptive statistics (Table 2) reveals the following.

The mean score of 2.46 with a standard deviation of 0.383 indicates a moderate level of tracking and tracing performance. The between-group variability (0.304) suggests some differences in tracking and tracing performance across countries. The within-group variability (0.241) reflects variation in tracking and tracing performance within each country over time. Regarding logistics competency, the mean score of 2.29 with a standard deviation of 0.369 suggests a moderate level of logistics competency. The between-group variability (0.284) indicates differences in competency perceptions across countries. The within-group variability (0.242) reflects variation in competency perceptions within each country over time.

The mean score for customs clearance processes is 2.79 with a standard deviation of 0.487, suggesting a moderate to high level of satisfaction with customs clearance processes. The between-group variability (0.381) suggests differences in perceptions of customs clearance across countries. The within-group variability (0.313) reflects variation in perceptions of customs clearance within each country over time. With respect to timely delivery of consignment, the mean score of 2.58 with a standard deviation of 0.413 suggests a moderate level of satisfaction with timely delivery. The between-group variability (0.354) indicates differences in perceptions of timely delivery across countries. The within-group variability (0.223) reflects variation in perceptions of timely delivery within each country over time. Meanwhile, the mean score of 2.31 with a standard deviation of 0.417 suggests a moderate level of overall outbound logistics performance. The between-group variability (0.343) indicates differences in perceptions of outbound logistics performance across countries. The within-group variability (0.246) reflects variation in perceptions of outbound logistics performance within each country over time.

Table 2: Descriptive statistics for study variables

| Variable | | Mean | Standard Deviation | Mini-mum | Maxi-mum |
|---|---|---|---|---|---|
| Consignment Tracking & Tracing (1=low to 5=high) | Overall | 2.46 | .383 | 1.84 | 3.75 |
| | Between | | .304 | 2.09 | 3.54 |
| | Within | | .241 | 1.86 | 3.20 |
| Logistics Competency (1=low to 5=high) | Overall | 2.29 | .369 | 1.5 | 3.6 |
| | Between | | .284 | 1.86 | 3.29 |
| | Within | | .242 | 1.54 | 3.04 |
| Customs Clearance Processes (1=low to 5=high) | Overall | 2.79 | .487 | 1.57 | 4.03 |
| | Between | | .381 | 1.96 | 3.85 |
| | Within | | .313 | 1.87 | 3.79 |
| Timely Delivery of Consignment (1=low to 5=high) | Overall | 2.58 | .413 | 1.7 | 3.78 |
| | Between | | .354 | 2.03 | 3.54 |
| | Within | | .223 | 2.01 | 3.11 |
| Outbound Logistics Performance (1=low to 5=high) | Overall | 2.31 | .417 | 1.27 | 3.79 |
| | Between | | .343 | 1.76 | 3.48 |
| | Within | | .246 | 1.64 | 3.03 |

Source: Hausman Test Results for Fixed Effects and Random Effects Models

Based on the results of the Hausman test, which is presented in Table 3, the test for systematic differences in coefficients between a Fixed Effects (FE) model and a Random Effects (RE) model is conducted. The Hausman test statistic (chi2) is found to be statistically significant at the 0.05 level (Prob>chi2 = 0.0005) (Table 3). This significant result indicates the presence of systematic differences in coefficients between the two models. Consequently, the Fixed Effects (FE) model is deemed more appropriate. The FE model accounts for time-invariant heterogeneity across countries and controls for unobserved factors that vary across countries, making it preferable over the Random Effects (RE) model. The RE model assumes that the individual-specific effects are uncorrelated with the independent variables. However, the significant Hausman test result suggests that this assumption is violated, as evidenced by systematic differences in coefficients in outbound logistics performance (OLP) across the selected countries over time.

In Table 3, one sees the Hausman test results comparing the Fixed Effects and Random Effects models. The significant chi2 statistic and the Prob>chi2 value of 0.0005 highlight systematic differences in coefficients, reinforcing the choice of the Fixed Effects model as the more suitable option for analyzing outbound logistics performance (OLP) across countries over time.

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Table 3: Hausman Test Results for Fixed Effects and Random Effects Models

| | Coefficients | | | |
|---|---|---|---|---|
| | (b) fe | (B) re | (b-B) Difference | Sqrt (Diag(V_b-V_B)) S.E. |
| Consignment Tracking & Tracing | -.032 | .143 | -.175 | .053 |
| Logistics Competency | .202 | .384 | -.182 | .053 |
| Customs Clearance Processes | -.195 | -.011 | -.184 | .052 |
| Timely Delivery of Consignment | .887 | .495 | .392 | .134 |

chi2 (4) = (b-B)'[(V_b-V_B) ^ (-1)] (b-B) = 20.08
Prob>chi2 = 0.0005

Source: Adapted from Hausman, J.A. (1978). Specification tests in econometrics. Econometrica, 46(6), 1251-1271.

## Fixed Effects Regression Results

Table 4 presents the fixed effects regression results, showing that TDC has a statistically significant positive effect on outbound logistics performance, with a coefficient of 0.887 ($p < 0.001$). This finding implies that the timely delivery of consignments plays a critical role in enhancing logistics efficiency across SSA countries. Similarly, CCP has a positive and statistically significant effect on outbound logistics performance, with a coefficient of 0.195 ($p = 0.006$), indicating that efficient customs processes are crucial for improving outbound logistics. LC has a positive effect on outbound logistics performance but is only marginally statistically significant ($p = 0.058$). On the other hand, TT does not exhibit a statistically significant effect ($p = 0.767$).

Table 4 illustrates the variations in outbound logistics performance between countries and highlights the importance of certain determinants over others. The overall R-squared value of 0.731 suggests that the model explains 73.1% of the variation in outbound logistics performance. However, the joint significance test (F test) with a p-value of 0.027 indicates that there is some evidence that individual country effects are non-zero, meaning that outbound logistics performance varies across countries.

Table 4: Fixed effects regression results

| Fixed effects (within) regression | | | | Number of obs = 110 | | |
|---|---|---|---|---|---|---|
| Group Variable: ID | | | | Number of groups = 22 | | |
| R-sq: | | | | Obs per group | | |
| | Within = 0.649 | | | | min = | 5 |
| | Between = 0.779 | | | | avg = | 5.0 |
| | Overall = 0.731 | | | | max = | 5 |
| | | | | | F(4, 84) | 38.8 |
| corr (u_i, Xb) = -0.1944 | | | | | Prob>F | 0.000 |
| OLP | Coef. | Std. Err. | t | p> | [95% Conf. Interval] | |
| TT | -.032 | .107 | -0.30 | 0.767 | -.245 | .182 |
| LC | .202 | .105 | 1.92 | 0.058 | -.007 | .411 |
| CCP | -.195 | .069 | -2.84 | 0.006 | -.331 | -.058 |
| TDC | .887 | .161 | 5.50 | 0.000 | .566 | 1.21 |
| _cons | .182 | .190 | 0.96 | 0.341 | -.196 | .560 |
| sigma_u | .166 | | | | | |
| sigma_e | .166 | | | | | |
| rho | .499 (fraction of variance due to u_i) | | | | | |

F test that all u_i = 0: F (21, 84) = 1.84
Prob F > 0.027

Source: Fixed effects regression results for determinants of outbound logistics performance. Created by Author, 2024.

Given these findings, the researchers infer that outbound logistics performance is a function of identified factors as represented by equation 1 and note that tracking and tracing (TT) may not be significant in the long run.

$$OLP_{it} = -0.032TT_{it} + 0.202LC_{it} - 0.195CCP_{it} + 0.887TDC_{it} + 0.182 + \vartheta_t + U_{it} \ldots\ldots \text{equation 1}$$

## Discussions

Outbound logistics focuses on the demand side of the supply-demand equation. The process involves storing and moving goods to the customer or end user and varies in distribution channels across countries and with time. The first distribution channel involves the producer, wholesaler, retailer, and consumer in that order. The second channel moves from production to the consumer via the retailer, while the last channel moves goods from the producer directly to the consumer (Jenkins, 2023). Research has shown that companies with good supply chains tend to have higher revenue growth. Only a tiny percentage of companies with poor supply chains have increased

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profits. Hence, it is essential to have a solid outbound logistics system (Deloitte, 2024). Thus, the goal of this study is to establish the determinants of outbound logistics performance bearing in mind cross-country and time-bound variations in SSA.

This study first reveals that timely delivery of consignment as a proxy of outbound logistics has a statistically significant positive effect on outbound logistics performance. In doing so, the study confirms findings of other previous scholars (Karlsson & Reumark, 2007; Klumpp & Heragu, 2019) who point to direct deliveries, cross-docking, and speed distribution strategies required to address evolving market and customer demands. However, unlike previous research, this study employs panel data with the fixed effects model which controlled for country and time fixed effects, guaranteeing that the significant positive effect is due to the genuine relationship between timely delivery of consignment and outbound logistics performance.

Second, the study shows that in the case of the fixed effects model, customs clearance processes have a negative and significant effect on outbound logistics performance. This finding is in contrast with Makori (2017) who uses the service sector in Kenya to show that government customs service regulations and procedures exert a significant influence on the efficient implementation of logistics management operations. The finding of this study also negates the finding by Shikur (2022) who uses the developing country perspective to show that customs clearance among other logistics performance dimensions positively and significantly influence the export and import of merchandise goods and services.

Suffice it to say, Makori (2017) uses descriptive statistics, presenting results in tables, pie charts and bar graphs. On the other hand, Shikur (2022) uses the General Least Square (GLS) regression approach. These approaches do not account for diversity in sectors/countries, and do not show the influence of temporal changes. Therefore, in using the fixed effects model, the finding of this study underscores the importance of not ignoring the country and time fixed effects when finding the genuine relationship between customs clearance processes and outbound logistics performance.

Third, the results for the effect of logistics competency on outbound logistics performance suggests that an increase in logistics competency is associated with a positive effect on outbound logistics performance, although it was marginally statistically significant. This implies that entities with higher levels of logistics competency tend to have slightly better outbound logistics performance, but the effect is not strong enough to reach conventional levels of statistical significance. This finding supports the finding by Shikur (2022) who indicates that logistics quality, international, and infrastructure all facets of logistics competency positively and significantly impact outbound and inbound logistics.

However, while Shikur reports robust coefficients, this study using the fixed effects model reports marginally significant coefficients. This contrast could perhaps be explained by the fact that the fixed effects model controlled for country and time fixed effects, guaranteeing that the marginally significant positive effect is due to the genuine relationship between logistics competency and outbound logistics performance.

This study finally reveals that consignment tracking and tracing as a measure of outbound logistics has a negative but non-significant effect on outbound logistics performance. In doing so, the study contradicts findings of other studies (Bolte & Goll, (2020; Shamsuzzoha et al., 2021; Shikur, 2022) that point to direct effect of tracking and tracing on logistics performance. Considering that unlike previous research, this study employs panel data with the fixed effects model, which is controlled for country and time fixed effects, the researchers can argue that the significant positive effect reported by other scholars exists only in the short term. This essentially suggests a lack of Granger causality between consignment tracking and tracing and outbound logistics performance.

## Theoretical Implications

A Panel Data Analysis contributes significantly to theoretical and practical understandings of logistics performance in the region. By integrating various theoretical perspectives, the study elucidates crucial factors influencing outbound logistics across diverse SSA countries. The Resource-Based View (RBV) underscores the importance of internal resources like advanced tracking systems and skilled personnel in enhancing logistics efficiency. Transaction Cost Economics (TCE) emphasizes minimizing costs associated with delays and inefficiencies at customs and in logistics processes. Institutional Theory highlights the role of regulatory compliance and industry norms in shaping logistics operations, while Network Theory

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underscores the significance of strong partnerships and information sharing within supply chains.

The study findings indicate that timely delivery of consignments and efficient customs clearance processes significantly enhance outbound logistics performance in SSA. These factors are critical amidst the region infrastructural challenges and economic variability. The use of panel data analysis reveals substantial variations in logistics performance both within and between countries over time, supporting tailored strategies for improving logistics efficiency. Practically, the research suggests investments in improving logistics competence, enhancing customs procedures, and adopting advanced tracking technologies to mitigate delays and improve reliability in consignment delivery. Such enhancements not only reduce transaction costs but also enhance customer satisfaction and overall supply chain efficiency in the region.

### Managerial Implications

Effective management strategies should focus on enhancing consignment tracking and tracing capabilities, improving logistics competence through training and technology adoption, streamlining customs clearance processes, and ensuring timely delivery of consignments. Managers can leverage these insights to optimize operational efficiencies and reduce costs, thereby improving overall outbound logistics performance.

### Policy Implications

Policy makers should prioritize investments in infrastructure development, particularly in road and port facilities, to alleviate bottlenecks and reduce transportation costs. Regulatory reforms should aim to standardize customs procedures and enhance transparency, facilitating smoother logistics operations across SSA. Additionally, policies supporting technological advancements and skill development in the logistics sector can enhance regional competitiveness and attract investment in logistics infrastructure.

## Conclusion

In conclusion, this study identifies several key determinants of outbound logistics performance in SSA using a panel data approach with fixed effects modeling. Timely delivery of consignments emerges as a significant driver of improved logistics performance, underscoring the importance of adherence to schedules and reducing transit times. Conversely, customs clearance processes exhibit a negative impact, highlighting inefficiencies that hinder logistics efficiency across the region. Logistics competency shows a marginal positive effect, suggesting room for improvement in skill development and technological adoption within logistics operations.

## Limitations

Despite its contributions, this study has some limitations that merit consideration. First, the data cover a span from 2010 to 2018, which may not capture recent developments or changes in logistics infrastructure and practices. Second, the study focuses on a select number of SSA countries, limiting generalizability across the entire region. Third, while fixed effects modeling controls for time-invariant heterogeneity, it may not fully account for dynamic changes within countries over time. Fourth, the study reliance on secondary data sources could introduce biases or inaccuracies inherent in the data collection processes of these sources.

## Recommendations for Future Research

Future research could address these limitations by incorporating more recent data to capture current trends and developments in logistics performance. Employing more extensive geographical coverage within SSA could enhance the generalizability of findings. Additionally, exploring more advanced econometric techniques such as Granger causality and cointegration tests could provide deeper insights into the causal relationships among the identified determinants and outbound logistics performance. Lastly, qualitative studies could complement quantitative findings by offering nuanced understandings of institutional factors and local contexts influencing logistics operations in SSA. By addressing these recommendations, future studies can further refine one's understanding of outbound logistics dynamics in SSA and provide actionable insights for policymakers, managers, and stakeholders aiming to improve logistics efficiency and economic development in the region.

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