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Evaluating the Impact of Transportation Costs, Supply Chain Reliability, and Operational Efficiency on Global Import Decisions

Mohamed H. Abdelati^{a*}, Hilal A. Abdelawli^b

^(a) Teaching Assistant Automotive and Tractor Eng. Dept., Minia University, Egypt.

^(b) Automotive and Marine Department, College of Technological Studies, PAAET, Kuwait

*Corresponding author: Email address: m.hilal@mu.edu.eg

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ABSTRACT

The effectiveness of goods importation versus domestic production comes into consideration when considering transportation costs, supply chain reliability, and operational efficiency. Accordingly, in this paper, a theoretical model was developed and tested for scenario analysis. The simulation showed a significant impact of these factors on trade decisions. Despite the critical role of transportation costs, this study found they had to be put in a harmonious framework considering supply chain reliability and efficiencies. High supply chain reliability may mitigate risks due to high transportation costs, permitting imports under more challenging conditions. On the other hand, low reliability may translate into a lack of discouragement for imports, even with low transportation costs, raising the specter of delays and disruptions in the bargain. In this way, operational efficiency must be seen as one of the basic building blocks of sustainable importing. It enables firms to absorb as many additional costs as possible to integrate supplied goods effectively. This means that the research indicates several practical implications for firms and policymakers regarding the importance of increasing supply chain reliability and operational performance. Similarly, the study limitations, hypothetical in nature, and model simulation suggest that research conducted further empirical validation for the respective theoretical model.

Keywords: Linear programming, network flow model, transportation costs, supply chain reliability, import decision-making

1. INTRODUCTION

Globalization has made world trade more compounded and interrelated; technological advancement, new geopolitical Blocs, and alterations in use demand bring about the development of world trade contemporary[1]. Business operators and policymakers in this web of relationships must make the most strategic decision between importation and local manufacture. This decision is influenced by combinative motivation such as transportation costs, reliable supply chains, and efficiency in any business. It is necessary to grasp the relationship between these factors to enhance the global trade strategies for achieving a competitive edge in the challenging market[2].

1.1 Background and Context

Over the years, there has been recognition that the cost of transportation is among the critical influences in trade. When firms expand their operations across national boundaries, issues to do with the transportation of products from one location to the other come into the picture[3]. They will, therefore, be pegged on fuel costs, road network development, and transport organization. Such factors define how goods are imported or made within the country. On the other hand, transport cost features in decisions made regarding trade only occasionally. What is more, transportation costs have to be considered in connection with the stability of the supply chain[4].

As a concept, supply chain reliability refers to the ability of an individual to deliver one's merchandise where it is demanded by the market, in the right quality and quantity. Maintaining reliability in the supply chains that can be country- or continent-based in the global economy context must be one of the most challenging yet very significant responsibilities. This is especially true of disruptive situations. Here, disruptions are foreseen in scenarios of natural disasters, political instabilities, and, last but not least, simple logistical failures that trigger delays, cost overruns, and lost revenues. For this reason, firms have to compare the likely hazards of importing the finished products against the stability of the supply chain[5].

Operational efficiency is the third complicating factor. Even in countries with low transportation costs and reliable supply chains[6, 7], internal firm capabilities matter. In firms with high operational efficiency[8], some of the risks and costs of importing may be overcome, enabling the firms to not just survive, but thrive despite external adverse conditions. In firms characterized by inefficiency, these very same difficulties may be magnified, rendering domestic manufacturing more desirable[9, 10].

1.2 Problem Statement

Though there may be a direct monetary advantage to producing more at home instead of abroad, many firms and countries continue importing goods. This brings us to the crux: Why make these moves if domestically produced products could appear more economically feasible? While there have been discrete analyses of transportation expenses, supply chain predictability, and speed to market in trade decisions, more research is needed on the balance between these factors. This paper fills this gap by building an integrated model of these three variables for supporting global strategic decisions.

This setup has been carefully done to touch various aspects of International Trade scenarios in general without getting into the details that are restricted to any particular country or Region. While the insights are meant to be broadly applicable, they will likely require modification in regions with differing trade environments and logistical constraints.

Noting that the model is meant to apply primarily to sectors where firms have discretion between importing goods and domestic production, it leaves out industries with a high degree of localization, such as those subject to specific regulations (e.g., defense) or unique product characteristics (e.g., perishables).

Since no empirical data is available, the study uses a model to simulate hypothetical scenarios. These scenarios are created to portray a s-eye view of trading mechanics while not reflecting all the nuances and variables in actual situations, looking instead at what will be noticed as trends over stable market conditions.

Despite the rapid fluctuation, this model also holds constant external factors such as fuel prices and infrastructure quality. Therefore, the findings should be taken to represent large-scale trends instead of accurate predictions (which would need a more fine-grained dataset).

Additionally, the model and scenarios consider medium to long-term trade decision perspectives with consistent supply chain reliability & operational capability over time. Though these near-term disruptions, being key on-the-ground factors, are recognized but kept out of the main scope for purposes of this study.

1.3 Research Objectives

This research aims to develop a conceptual model explaining the import and domestic production choice of goods, with critical consideration of the role of transportation costs, supply chain reputation, and operational efficiency at deciding time. From this, the specific objectives would be:

- To study the impact of transportation costs in making decisions regarding imports with due consideration of changes in rack fuel prices, transportation infrastructure, and logistics efficiency.
- Research the impact of the supply chain reliability issue on import decisions, significantly when the supply chain increases its focus on risk mitigation of global trade.
- Determine the impact of operational efficiency on the import decision in a study of how "the ability on the inside" is weighed against "the cost and risk on the outside."
- Use Operations Research tools to run "what if" scenarios and quantify the influences on import decisions.

1.4 Significance of the Study

This paper will contribute to the theoretical and practical understanding of global trade by analyzing the factors determining importing decisions. These added details of the model, with the inclusion of transportation costs, reliability of the supply chain, and operational efficiencies, are helpful for an enhanced understanding of global trade dynamics. Therefore, the details are essential to businesses in forming strategies for optimal sourcing and production decisions in increasingly complex global supply chains. In doing so, the gained insight can be helpful to policymakers in creating trade policies meant to reinforce resilience and competitiveness in the economy, as well as in investment decisions on infrastructure.

2. LITERATURE REVIEW

The literature dealing with the decision about importing goods versus domestic production is expansive, cutting across many theories and models from transportation economics, supply chain management, and operations research[11]. This section assimilates central ideas from these different fields and helps lay the platform for the conceptual model to be developed in this study. This literature review aims to identify gaps in previous studies that would be filled by this study, especially in understanding how transportation costs, supply chain reliability, and operational efficiency are integrated into global trade decisions[12].

2.1 Transportation Economics

Transportation costs have been a central issue in studies relating to global trade for many centuries. Traditional economic models, such as Ricardo's and Heckscher-Ohlin's, are oriented toward the trading countries' comparative advantages, which are influenced by transportation costs[13]. The evolution of

globalization has shifted the spotlight from superficial differences in cost to the details of how infrastructural facilities, fuel prices, and logistics efficiency impact trade decisions[14, 15].

This analysis then served as a basis for many of the integration concerns outlined by Davis [16] regarding comparative advantage within international trade under transportation costs and economies scale when compared to Heckscher-Ohlin and traditional theories. However, his work also shows that international trade can still be beneficial due to the efficiencies produced by comparative advantage, which often outweigh transaction costs. The study underscores that transportation costs are not the only determinant; in sectors where product differentiation and economies of scale matter, it is also how inherent production efficiencies between trading countries support trade. This process exemplifies why, despite high transportation costs, international trade can still be effective, especially when each producer has a comparative advantage about at least one product [17, 18]. By incorporating these theories of comparative advantage into trade frameworks, we have achieved a more complete understanding of when nations or firms choose to produce domestically versus importing production work as it pertains to the model presented in this study regarding balancing transportation costs against supply chain reliability and operational efficiency.

Recent research has underlined the complexity of transport costs, underscoring variability and the drivers. As Rodrigue et al. say, transportation costs are not functions of distance; instead, they very strongly depend on the infrastructure quality and the logistics network's efficiency[19]. This has led to a more sophisticated understanding of how transportation costs affect the feasibility of importing goods versus producing them domestically. It is evident in the literature that the relationship between transport costs and trade volumes is not linear. This means that small changes in costs can have substantial, disproportionate, that is, effects on trade decisions, according to Hummels (2007)[1].

Whereas the effects of transportation costs on trade have been documented, less is known about the interactions between these costs and other factors that characterize supply chain reliability and operational efficiency in shaping import decisions. This literature gap prioritizes the need for an integrated approach that considers the multifaceted nature of transportation costs within the broader context of global trade.

2.2 Supply Chain Management

This has also involved critical research into supply chain management, a discipline that overlaps with the study of world trade[20]. In the evolving business environment, firms are increasingly operating across

borders within which supply chain management becomes more complex and crucial for success[21, 22]. Literature on supply chain management stresses reliability, resilience, and risk management as significant elements of ensuring seamless flows of goods across borders[23].

As for the concept of supply chain reliability, it is well explored in the literature. As described by Christopher, 2016[20], the meaning of SCM pertains to the capacity of a particular supply chain to provide customers with the right products at the right time in the correct quantity and quality. Several factors are used to make this decision, including the stability of the logistic networks, present suppliers, and measures taken in case of disruption. In Sheffi 2005[24], work is done more on resilient supply chains, analyzing how firms can create capacity within the supply chains to rapidly respond to shocks and bounce back to the right track[25].

The reliability of a supply chain is more important than ever, amid the brutal disruptions recently seen across the globe (among others) in reaction to exogenous global events like COVID-19. Christopher [26] stress that as events cascade through global supply chains the ability to absorb shocks is one of the key attributes which businesses require if they are to maintain continuity in often unpredictable operating environments. Other researches [27-29] highlight that organizations need to keep their supply chains robustly prepared for quick recovery from those similar shocks, in order the risks with global trade could be relieved if not avoided. These points improve the success factor of high transportation cost by providing an example where a lower logistic challenge as output increases because it offers more bottleneck possibility in international trade[30].

The literature also highlighted that cost-reliability trade-off is another problem that firms experience. For instance, the JIT inventory systems that reduce the cost through the lowering of inventory levels are prone to disruption of the supply chain (Chopra & Meindl, 2019)[31]. This forms a particularly pertinent trade-off in international business, given that while firms seek to reduce the cost of importing goods, they risk facing supply shocks.

Although there is much literature on supply chain management and its relationship between supply chain reliability and import decisions, there is a shortage of literature on the issue, with a focus on fluctuating transportation costs and changes in operational productivity[32, 33]. Hence, the present study will try to fill this gap by exploring the combined effects of the above-mentioned influencing factors on trade decisions.

2.3 Operations Research Models in Trade Decisions

Operations research offers powerful tools for the analysis and optimization of decisions in complex systems, making it highly relevant to the study of world trade and import decisions[34]. The application of OR tools to trade decisions involves mathematical modeling and simulation techniques aimed at achieving optimality in various aspects of the supply chain, including transportation[35, 36], inventory, and production planning. This potential for optimization should inspire optimism about the future of global trade.

LP is applied to the most significant extent in trade decision-making of all the OR techniques. It has been applied to routing problems for transportation, cost minimization, and efficient resource allocation in scenarios where firms have to decide between importing the goods or producing them within the country. Winston, 2004[37], gives an excellent account of how LP can solve most supply chain problems and, therefore, helps optimize trade decisions.

While LP has often been used in this context, other OR techniques have also been applied to understanding global supply chain dynamics, particularly network flow models and simulation. Network flow models are mainly used to understand the movement of goods through complex supply chains to help identify bottlenecks and optimize the flow of goods from the supplier to the consumer. Simulation methods allow one to model various scenarios and quantify the impacts of different factors on trade decisions, such as transport cost changes or supply chain disruptions.

Although OR techniques have been reasonably applied in supply chain management, there still exists an opportunity to integrate those methods into transportation costs, supply chain reliability, and operational efficiency in import decisions. This paper aims to further this stream of research by modeling alternate trade scenarios using OR methodologies, focusing on quantifying the impact of these drivers on global trade decisions.

2.4 Integration of Concepts

The knowledge of transportation economics, supply chain management and operations research can be mined from today's literature to capture and evaluate the effecting factors that define the consequent decisions for global trade. These areas have, however, to a great extent been researched individually, thus why there is a disjointed picture of the relationship between transportation costs, supply chain risk, and operating efficiency in import decisions.

In our study, we incorporate all these concepts to develop a systematic framework that encapsulates the general dynamics of global trade. Building from these two disciplines, we create a concept that integrates insights from transportation economics, supply chain management, and operations research to explain the relationship between these factors. This should put the reader at ease, knowing that we have covered all that could be considered while arriving at the conclusions.

This paper's literature review section clearly reveals the need for and importance of an integrated approach to analyzing global trade decisions. While quite a number of studies explain the factors affecting transportation costs, supply chain reliability, and operation efficiency, there is a lack of insight into how these factors interrelate. The present research addresses this issue by developing a comprehensive conceptual model that integrates these components, providing fresh perspectives on what influences the choice to import or domestically manufacture products.

3. THEORITICAL FRAMEWORK DEVELOPMENT

This is the interaction of several variables, including transportation cost, supply chain risk, and operation excellence, which has informed our study. To understand this interaction, we have formulated a theoretical model that is not a mere exercise in speculation but a working model that can be used from this moment. The information from the field of transportation economics, supply chain management, and operations research will contribute to developing this framework for identifying conditions under which importation becomes more preferable to domestic production of goods and valuable for decision-making in international trade.

3.1 Conceptual Model

The model is based on transportation costs as the primary driver for all global trade decisions[38]. Transport costs directly impact the total cost of importing goods. By statement, this shall incorporate all costs involved in fuel, shipment, tariffs, and use of infrastructure. These cannot, however, be considered in isolation. The reliability of a supply chain refers to the ability to provide goods in a timely and predictable manner. It acts as an influencing factor in the cost of transportation. A more reliable supply line will help adjust some effects of the high transportation costs by ensuring the products arrive at their destination on time and in good condition, hence maintaining production efficiency.

Operational efficiency is another crucial element of the framework, which refers to the internal processes and capabilities that define how well a firm can effectively integrate imported goods into the firm's

production operations. Firms with high operational efficiency absorb many external costs associated with importing, especially those ascribable to transportation, through better-structuring production processes that reduce wastage and enhance productivity. While low operational efficiency may create a scenario in which the costs of external factors are overwhelmingly high, it becomes more attractive to produce domestically, even in the presence of higher initial costs.

This decision to import is a function of these three factors: transport, supply chain reliability, and operational efficiency.

1. With reduced transportation costs, the likelihood of importing goods will increase, especially when the supply chain reliability is high. The risks associated with ruptures in the supply chain are minimal; hence, the cost benefits from importing are quickly realized.

2. High supply chain reliability positively affects the decision to import, even in the presence of moderate or high transport costs. More reliable supply chains reduce the uncertainty associated with importing, providing a sense of reassurance and thus making importing more viable for many firms that must stay as close as possible to their production schedules.

3. Due to the high operational efficiency, transportation becomes feasible and very manageable, thus making it more appealing to import instead of developing or manufacturing the goods in one's country. More efficient companies can better incorporate imported products into their business and compensate for some of the extra importation costs while maintaining their profitability, instilling a sense of optimism about the potential for success.

3.2 Transportation Costs and Supply Chain Reliability

Transportation costs, which encompass generic aspects like fuel, shipping, tariffs, and logistical costs, all define the fundamental determinant of the profitability of imported goods. In any event, transportation costs, more than any other influence, can motivate or deter the firm from engaging in international sourcing. However, more than transportation costs alone are required to ensure more precise imaging. Based on the consistency and predictability of sound delivery, supply chain reliability moderates these costs. Reliable supply chains help manage associated risks of high transportation costs; firms have the assurance that goods will be where they are supposed to be when they are supposed to be there, so disruptions in production can be minimized.

On the other hand, where the supply chain is not dependable, the import risks involved are significantly skyrocketed. Delays, disruptions, and variability of delivery are considered reasons causing excess inventory costs, production downtime, and a competitive disadvantage. While in these situations, the transportation cost is meager, the supply chain's uncertainty could make domestic production more favorable.

3.3 Operational Efficiency and Import Decisions

Operational efficiency in any firm reflects how well it will absorb and handle other external costs, including those of importing goods. This makes integrating imported goods into production processes more seamless, reducing processes like wastage and increasing productivity. This can offset some of the added costs related to transportation and general supply-chain risks; therefore, import is a more viable option even when external conditions are challenging.

In cases of high organizational inefficiencies, however, the joint cost of transportation and the unreliability cost of the supply chain might not compare all that favorably with the benefits of importing. In such cases, the sources of inefficiency within the firm increase the challenge of dealing with external costs, pushing the firm toward producing domestically, where it has more control over inputs and processes.

Several critical ideas in this theoretical framework – the decrease in transportation costs, the increase of reliability of the supply chain, and the improvement of the operating efficiency – describe the process of making decisions in the context of imports. Therefore, the framework offers a holistic view of international trade because it considers the interaction of these variables. The following sections endeavor to apply it under strict structural grids intended for tracing the academically sound and practically valuable effects of this model.

4. SCENARIO ANALYSIS

The pivotal Scenario Analysis section is not just a theoretical exercise but a practical exploration of various trade scenarios that can shed light on the complex conditions under which imported goods might be preferred to domestic production. This section is designed to rigorously test the intricate interplay between transportation costs, supply chain reliability, and operational efficiency in import decisions, providing real-world insights for business executives, policymakers, and professionals involved in global trade and supply chain management. The analysis involves:

- The creation of hypothetical scenarios.

- The application of operations research techniques to simulate these scenarios.
- A comprehensive discussion of the results.

This study refers to historic trade scenarios that this research deems as real-life examples of the theoretical possibilities analyzed here. The 2008 global fuel price surge, for example[39], forced many companies to recalculate importing costs and then switch temporary production here at home on certain items as transportation cost were becoming too high. At the same time, geopolitical events such as U.S.-China trade tensions underscored concerns about supply chain reliability and resilience when it came to making import decisions. Utilising these cases, the scenarios within this study are shaped in order to mimic real world decision-making landscapes where transportation expenses have an impact upon global trade strategies from aspects of supply chain reliability and operational performance.

4.1 Hypothetical Scenarios

The hypothetical Scenarios section was set up with a specific purpose in mind-to examine the relationships of transportation costs, supply chain reliability, and operational efficiency. These scenarios reflect actual world conditions facing a business or policymaker when determining whether to import goods into their country or to produce such goods domestically.

Scenario 1: High Transportation Costs with High Supply Chain Reliability

- In such a case, transport prices are high due to increased fuel or higher tariffs, while the supply chain can be very reliable. This scenario is exciting in contexts where geopolitical tension or a trade war causes a spike in transportation costs, but the underlying logistics network is well-developed and stable.

Scenario 2: Low Cost of Transportation with Low Reliability of Supply Chain

- In this scenario, transportation costs are low due to specific trade pacts, good logistics, or low fuel costs. However, it is joined by an unreliable supply chain, which generally experiences frequent delays, disruptions, and delivery time variability. This reflects the conditions under which cost savings are possible but with the risk of essential challenges to the supply chain.

Scenario 3: Medium Cost of Transportation with High Operational Efficiency

- In this case, transport costs are moderate, neither very high to prohibit nor very low. In contrast, the firm or country concerned has high efficiency, meaning that imported goods can be integrated into the production process of the firm or the country concerned with a seamless and low-cost

approach. This case, therefore, reviews the extent to which internal efficiencies are willing to offset the external transportation costs.

Scenario 4: High Transport Costs and Low Supply Chain Reliability

- This scenario is challenging with high freight costs and a sensitive supply chain. An extreme event could be a global pandemic, natural disaster, or political instability. In this case, such a scenario would stress the theoretical model about identifying the tipping point at which firms or countries move to domestic production rather than importing.

Scenario 5: Preferential Trade Agreements with Improved Resilience of Supply Chains

- In this scenario, a company or country enjoys preferential trading agreements that reduce tariffs and cut transportation costs but, at the same time, invests in infrastructure and strategies to increase the resilience of supply chains. This evaluates how much favorable external elements—supportive trade policies and resilient logistics networks—impact decisions to import.

4.2 Model Simulations

The above scenarios are simulated using operations research techniques to make decisions. The simulations can quantify dependent variables of the decision on where to import, vis-à-vis producing in-country, as a function of transportation costs, supply chain reliability, and operations efficiency.

1. Application of Linear Programming

Linear programming is employed to model the optimum allocation of resources between importing and domestic production under each scenario. It involves each option's respective costs and benefits, accounting for changes in transport costs and supply chain reliability. The goal is to find the optimal decision to produce the least total cost while maintaining production efficiency.

2. Network Flow Model Analysis

The network flow models are run to simulate the flow of goods through global supply chains. This considers how changes in transportation costs and supply chain reliability may impact the flow of goods from suppliers to consumers. By visualizing these flows, the model may recognize probable bottlenecks and inefficiencies that could influence the decision to import.

3. Sensitivity Analysis

Sensitivity analysis is then conducted to determine the degree to which the importation decision responds to changes in critical variables such as transport costs, fuel prices, and the reliability of the supply chain.

From this analysis, all these critical threshold values will be derived, which indicate ranges of small changes in the factor values leading to significant changes in trade decisions.

Figure 1 illustrates transportation costs and probability of importing under different levels of supply chain reliability. For large values of supply chain reliability, the green line shows that the likelihood of importing remains high even in the presence of high transportation costs since the reliable supply chain lowers associated risks. At medium values of supply chain reliability, the orange line, a more significant drop in the likelihood of importing, is seen with increasing transportation costs due to the extra risks introduced by its medium reliability. Finally, the red line plots a shallow level of supply chain reliability. While transport costs are rising, the likelihood of importing drops significantly in this case due to low reliability, which amplifies the risks of importing.

Impact of Transportation Costs on Likelihood of Importing under Different Supply Chain Reliability Levels

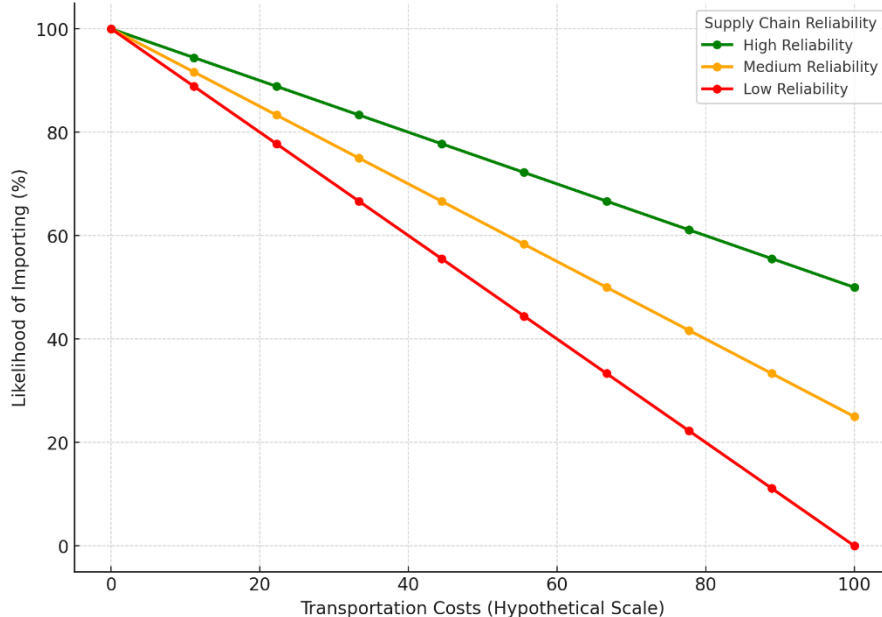


Figure 1 Impact of Transportation Costs on Likelihood of Importing under Different Supply Chain Reliability Levels

4.3 Discussion of Results

The results from the model simulations provide comprehensive insight into the conditions that influence import decisions. Different scenarios yield different outcomes, showing complex interactions among variables such as transportation costs, supply chain reliability, and operational efficiency. This

comprehensive discussion, which ensures that the audience is well-informed and knowledgeable about the implications of the scenarios, is a key part of our report.

1. High Transport Costs with High Supply Chain Reliability

In this case, results indicate that even with higher transportation costs, firms may still prefer to import if the supply chain is reliable. The reliability of the supply chain offsets part of the costs by reducing some risks of high costs that may threaten consistent production schedules.

2. Low Transportation Costs with Low Supply Chain Reliability

statements here manifest that even when the transport cost was low, the firms still needed to rely more on importation if the supply chain was unreliable. Those potential disruptions and delivery-time variability may create risks too high to be compensated by the reduction in variable costs alone; some may find domestic production a safer alternative.

3. Medium Transportation Cost with High Operational Efficiency

The analysis shows that high operational efficiency can compensate for moderate freight costs and thus provide an option to import. A firm with high operational efficiency is well placed to incorporate the imported inputs into the production line and remain profitable.

4. High Transportation Cost with Low Reliability in the Supply Chain

In this scenario, in particular, the simulations reveal that firms will be more inclined to produce domestically than import. High costs and an unreliable supply chain interact with one another to provide a hazardous environment within which benefits to import are reduced.

5. Better Trade Agreements with More Resilient Supply Chains

The results from this scenario indicate that when external conditions are favorable—reduced tariffs and improved resiliency of supply chains—the attractiveness of importing improves dramatically. This positive risk and cost-reducing impact mitigates the risk level and cost related to importing, making it more competitive.

The scenario analysis described the types of nuanced conditions under which firms and policymakers might decide to import goods rather than produce domestically. The results underscore the importance of considering transportation cost, supply chain reliability, and operation efficiency in making global trade decisions rather than in isolation. This holistic approach provides theoretical and practical insights that empower strategic decision-making in an increasingly complex global trading environment.

4.4 Model Application Example

Without a data source in the real world, this section aims to account for an example of how the theoretical model shown throughout this study would manifest in an actual trade. For example, a manufacturing firm weighing whether to import critical components or make them in the home country. The model shows the effect on firm decision-making if there were changes in transportation costs, supply chain reliability, and operational efficiency. To do that, it uses synthetic data made from industry yardsticks such as routine transportation expenses and standard supply chain reliability metrics.

In the case of this model application, synthetic data was generated for three key variables — transportation costs, supply chain reliability, and operational efficiency. For example, transportation costs were based on historical averages, and the reliability of a supply chain was quantified through traditional metrics like On-Time Delivery rates. Lastly, a sensitivity analysis was conducted during which each variable was altered and tested how the firm responded in both importing versus domestic production. Correlation analysis then investigated how these factors related to one another, and even where a costly transportation strategy could be compensated by higher supply chain reliability in certain trade scenarios. With theoretical data, it gives concrete intuition on how the model works and whether or not these predictions make any sense (even from day 1).

5. DISCUSSION

The scenario analysis results lend granularity to the complex interplay of transport cost, supply chain reliability, and operational efficiency as factors that shape import decisions. This section synthesizes the results and explores their theoretical and practical implications, broadening these insights into relevance for academic research and strategic decision-making in global trade.

5.1 Theoretical Implications

According to the simulations run under different scenarios, as vital as they are, transportation costs cannot be looked at in isolation in the decisions involving importation. Reliability in the supply chain emerged as a significant moderating variable that would amplify or mute the effects of transportation costs. For instance, when transportation costs are highly detrimental, but the supply chain is reliable, firms are more willing to maintain their imports. This finding supports the theory that a stable and predictable supply chain can help balance some of the added risks and higher costs brought about by more extraordinary transportation expenses.

The decision to import will also be less attractive when transportation costs are low while the supply chain could be more reliable. Delays, disruptions, and delivery time variability will outweigh the cost reductions, and firms will choose domestic production as a risk-averse strategy. Therefore, the role of supply chain management in global trade should be emphasized more. This also shows that reduced costs have to be weighed against the risks involved in the supply chain.

Operational efficiency is a crucial factor in import decisions. The results indicate that firms with higher operational efficiency can absorb external costs, such as increasing transportation costs, without reducing gains. They can efficiently handle imported goods by reducing resource wastage in the production process. In contrast, operationally less efficient firms struggle more when external costs rise, making domestic production a more attractive option.

Trade policies and investments in supply chain infrastructure play a significant role in making importing a more competitive option. As shown by the simulations, if trade policies drop tariffs and improve logistics infrastructure, the total cost and risk of importing decrease dramatically. These conditions make importing a more competitive option, even in cases where transportation costs might otherwise be prohibitive. This finding underscores the importance of supportive trade policies and investments in supply chain infrastructure as key enablers of global trade.

Theoretically, this research enriches a unified definition model of import decisions through transportation costs, supply chain reliability, and operational efficiency. These findings justify the need for considering these factors in combination rather than in isolation, therefore putting forth a holistic understanding of the dynamics that drive global trade. This unified approach plugs a gap in the literature where these elements have more often been examined in bits to result in fragmented insights.

5.2 Practical Implications

The implication of the findings in this research is of paramount importance for any business and policymakers. For businesses, it means that investing in supply chain reliability and operational efficiency not only mitigates external costs effectively but also provides a strategic advantage to the firm, empowering it to remain competitive in the global market. A company efficient in operations can absorb more of such pressures, at which point importing would still remain a feasible option. Moreover, companies that work towards improving the reliability of supply chains can reduce global sourcing risks

by assuring continuity and minimizing the possibilities of expensive disruptions, thereby taking a proactive stance in managing their supply chains.

The Model Application Example in Section 4.4 illustrates how firms can utilize this study's theoretical model within particular decision contexts. This example shows that when transportation costs are getting high, the firms with higher Supply chain reliability will import more to compensate for extra costs if they can. As the example also indicates, companies with superior operational efficiency are thus more capable of integrating overseas items amidst localized price hikes, reinforcing how powerful these advantages become in global trade. These insights support the growing emphasis on supply chain resilience and operational enhancements in recent years by firms wishing to capture competitive advantage within unpredictable trade scenarios.

On the other hand, policymakers are shown through this study that trade policies that decrease transportation costs and increase supply chain resiliency should be formulated. This would not only benefit the industries of a country but also improve the resiliency of the economy as a whole, making it possible for firms to make credible choices when it comes to sourcing goods internationally. Investments in ports, railways, and logistics networks are most valuable because they directly affect the feasibility of importing goods. Moreover, business-friendly trade agreements that bring down tariffs and facilitate cross-border logistics can further make importing more attractive and lead to economic gains by stimulating volumes of trade and lower consumer prices.

5.3 Limitations of the Study

While this study gives valuable insights, it has its limitations. These studies are based on hypothetical situations and model simulations, which are powerful tools for studying theoretical relationships but are too simplified to come close to explaining real-world conditions. Assumptions that enter into their construction cannot capture all the variables that determine trade decisions in practice. For example, the simplification of other key drivers of world trade, like geopolitical risks, cultural differences, or regulatory environments, might need to be more concise by the deployed models.

Due to the largely theoretical nature of this analysis, no real-world data was available. As such, default scenarios were created based on standard industry practices and historical averages. Though such an approach may constrain the exactitude of the conclusions, it does offer a valuable rendering of how dynamics revealed by models develop in conditions routinely seen in international trade. The scenarios

and case studies suggest further research building on these theoretical foundations, subjecting the model to real trade data for empirical validation.

Another limitation is that these three factors—transportation cost, supply chain reliability, and operational efficiency—although elaborate in their ways, cannot view the spectrum of factors that might impact import decisions. Some elements were not explicitly set out here: technological changes, environmental sustainability, and consumer preference; these would obviously significantly affect trade dynamics.

A Model Application Example included in this study offers an illustrative application of the theoretical model, drawing attention to the possible benefits despite a lack of empirical data. Nonetheless, synthetic data in this example restricts precision and requires more extensive empirical corroboration. Such a model could be tested under different trade conditions using real-world data, the results of which would allow for more general insights into the dynamics examined here. This would assist in confirming the theoretical underpinnings of this study and further explain the applicability of our model across multiple trading contexts.

6. CONCLUSION

The current paper aims to establish the nature and factors that make the decision-making process regarding the importation or local production of goods tiresome for firms and policymakers. The study has constructed, in general terms, a theoretical framework within which such essential trade decisions can be understood by highlighting the relationship between transport cost and supply chain risk and reliability and operating efficiency. This paper has also done the scenario analysis in the research to support when importing goods is preferable, showing theoretical and practical contributions. The study results include transportation cost, supply chain availability, and operating-cost parameters. This should not imply that trade decisions are based purely on the 'Cost of Transportation'; these must be viewed and facilitated within the general framework of supply chain considerations and firm-specific factors. A reliable supply chain can either minimize or phase out transport costs' impact, making importation possible under unfavorable transport costs. In another case, if the supply chain is unreliable, low transport costs may render importing unsuitable because of the credibility of untimely and interrupted supplies.

Another significant criterion that is relevant to such decisions is operational efficiency. More operationally efficient organizations can bear the external cost, predominantly the rising transportation costs, on their profitability. This allows the company to feed the imported goods into production with minimal scrap and

wasted time. On the other hand, low operational efficiency will make domesticate more appealing to firms due to more control and stability on the outside factors.

This research has tremendous practical implications. To businesses, it reinforces the timeliness message of supply chain reliability and operational efficiency as the fundamental competitive weapon in the contemporary global marketplace. It is clear to policymakers that strategic support for trade policies and infrastructure development will considerably improve global supply chain performance. Substantial economic reward can be gathered by enhancing preferential trade agreements that bring down the cost of transport and infrastructure in the supply chain, which enhances the supply chain shock.

Nevertheless, some restrictions must be mentioned concerning the attempt to advance a theoretical framework for analyzing contemporary media systems. As this work used hypothetical data and was model-based, such observation requires empirical substantiation. Thus, future work should continue employing this theoretical model to analyze real-world data to assess its robustness and, in addition, consider other factors that may affect the importation decision. This study continuously improves the knowledge about decision-making in international trade.

The research has filled the gap in the determinants of import decisions in international trade. Establishing the costs of transporting goods, supply chain dependability, and operational effectiveness within a structural framework makes this research more inclusive for assessing trade decisions. Therefore, the results are helpful for scholars and practitioners, thereby improving the analysis of global trade patterns and business strategies in the interconnected world.

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