

**INTERNATIONAL JOURNAL
OF LAW, GOVERNMENT
AND COMMUNICATION
(IJLGC)**www.gaexcellence.com/ijlgc**STRAIT OF HORMUZ TRADE DISRUPTION: IMPACTS ON
MALAYSIA'S FOOD PACKAGING SUPPLY CHAIN**

Farrah Dina Abd Razak¹, Nor Samsinar Kamsi^{2*}, Nor Marini Mohtar³, Mohd Akmal Sobari⁴,
Radin Firdaus Radin Badaruddin⁵

¹Department of Business and Management, Universiti Teknologi MARA Perak Branch Tapah Campus, 35400 Tapah Road, Perak, Malaysia.

✉ farra104@uitm.edu.my

iD <https://orcid.org/0000-0003-2331-1437>

²Department of Business and Management, Universiti Teknologi MARA Perak Branch Tapah Campus, 35400 Tapah Road, Perak, Malaysia.

✉ norsa837@uitm.edu.my

iD <https://orcid.org/0000-0002-6902-1606>

³Department of Business and Management, Universiti Teknologi MARA Perak Branch Seri Iskandar Campus, 32610 Seri Iskandar, Perak, Malaysia.

✉ norma506@uitm.edu.my

iD <https://orcid.org/0009-0006-2769-5131>

⁴School of Social Sciences, Universiti Sains Malaysia, 11800, Pulau Pinang, Malaysia

✉ akmalsobari@student.usm.my

iD <https://orcid.org/0009-0002-6073-4498>

⁵School of Social Sciences, Universiti Sains Malaysia, 11800, Pulau Pinang, Malaysia.

✉ radin@usm.my

iD <https://orcid.org/0000-0001-7022-0576>

*Corresponding Author

Article Info:**Article history:**

Received date: 30.07.2026

Revised date: 27.08.2026

Accepted date: 23.09.2026

Published date: 28.09.2026

Abstract:

This study examines whether the March 2026 geopolitical disruption associated with the reported closure and severe restriction of commercial transit through the Strait of Hormuz affected the Malaysia's food packaging related supply chain. Using 37 monthly observations from July 2023 to July 2026, the study estimates two sequential bivariate OLS models: Brent crude oil price with Malaysia's index of plastic manufacture, and the index of plastic manufacture with the food-product Producer Price Index (PPI). The conceptual framework combines the Ripple Effect Model, which specifies the proposed upstream-to-downstream propagation sequence, with the Exposure–Transmission–Buffering (ETB) framework, which is used to interpret vulnerability and buffering mechanisms. Empirical estimation confirms a positive, statistically significant relationship at upstream level while downstream estimation reveals a delayed transmission pattern, where

To cite this document:

Razak, F. D. A., Kamsi, N. S., Mohtar, N. M., Sobari, M. A., & Badaruddin, R. F. R. (2026). Strait Of Hormuz Trade Disruption: Impacts on Malaysia's Food Packaging Supply Chain. *International Journal of Law, Government and Communication*, 11(45), 791-804.

DOI: 10.35631/IJLGC.1145050

model variance reflects broader macroeconomic structural dynamics rather than immediate cost absorption. An exploratory cross-correlation lag analysis further provides empirical proof of a two-month operational buffering window within Malaysia's food packaging supply chain, but this is treated as descriptive evidence rather than a proven causal delay. The study also deals with food-contact risks related to chemical migration, contamination, material suitability and traceability. The results imply that supplier diversification, food-grade compliance, certified recycling capacity, and delayed-shock scenario planning should be considered. However, it is important to note that more time-series tests and supply-chain data are needed for more robust causal and firm-level conclusions.

Keyword:

Food Packaging, Strait of Hormuz, Supply Chain



© The authors (2026). This is an Open Access article distributed under the terms of the Creative Commons Attribution (CC BY NC) (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact ijlgc@gaexcellence.com.

Introduction

The Strait of Hormuz is a narrow waterway that connects the Persian Gulf with the Gulf of Oman and is a major shipping route for energy trade around the world. This study examines the geopolitical episode of March 2026, which the strait has been closed, commercial vessel traffic was sharply reduced, and rerouting was undertaken by major carriers (Rasmussen & Ghosh, 2026). This paper investigates the effect of the monthly change of Brent crude oil on Malaysia's index of plastic manufacturing and the effect of Malaysia's index of plastic manufacturing on the Producer Price Index (PPI) for food products, which are not assumed to be the direct result of any event but statistically associated with the change of the Brent crude oil. In Malaysia, the packaging sector plays a crucial role in manufacturing and distributing food that complies with the migration and food-contact safety standards for food-grade polymers (Gupta et al., 2024). This study adopts the Ripple Effect Model and the Exposure–Transmission–Buffering (ETB) framework where the ETB framework is used to identify exposure, transmission mechanisms and buffering responses, while the Ripple Effect Model shows the pathways of signal transduction from upstream to downstream.

Literature Review

The packaging industry in Malaysia is closely linked to the production of electronics, consumer products, food, and pharmaceuticals. International changes in petrochemical and energy prices impact this sector. Food-grade packaging comes with compliance requirements for material composition, chemical migration, traceability, and use in food contact situations (Gupta et al., 2024; Tumu et al., 2022). New information from the industry also shows that the resin prices went up significantly in the second quarter of 2026, after the conflict in the Middle East

(Kenanga Research, 2026). These developments motivate an empirical examination of whether upstream Brent price movements are statistically associated with Malaysia's plastic-manufacturing index and whether the plastic-manufacturing index is statistically associated with food-product PPI. The empirical analysis examines the monthly observations from July 2023 to July 2026 to explore the links and discuss their implications on the packaging resilience and food safety risk.

Recent research on supply-chain disruptions increasingly emphasizes the propagation of shocks across interconnected and interdependent tiers, recognizing that disruptions at one stage can trigger cascading effects throughout the broader supply chain. Shipping rerouting or fuel cost increases due to disruptions in the Strait of Hormuz or tighter maritime restrictions might increase inventory holding costs and delay polymer supply, affecting food-grade material quality. Logistics challenges, such as port congestion and energy costs, are sending more ripples through packaging, especially for export-oriented food sectors. The Ripple Effect Model (Ivanov et al., 2014; Dolgui et al., 2018) illustrates how problems can propagate along supply chains and affect prices, capacities and the network structure. Ghadge et al. (2020, 2022) show how system-dynamics approaches can be used to demonstrate how disruptions can have long-lasting and simultaneous effects. These studies are a good starting point for considering geopolitical shocks, but the literature does not directly test how an international energy shock impacted Malaysia's plastics industry and in turn, affected food producer prices during the March 2026 disruption of the Strait of Hormuz. Another diagnostic framework for the same propagation process, the Exposure-Transmission-Buffering (ETB) Framework, is a useful addition to the Ripple Effect Model (Sangwa & Murungu, 2026; Patsiaouras et al., 2026). In this study, "exposure" means that Malaysia depends on hydrocarbon and petrochemical inputs that are traded internationally, "transmission" means that price and logistics shocks travel through the food and plastic manufacturing chains, and "buffering" means stocks, contracts, other sources of supply, and other things can slow or stop transmission. In general, the Ripple Effect Model shows how the shock travels and how it can cause other shocks, ETB shows where the shock may be vulnerable and where it may be absorbed. In practice, the two frameworks are not empirically evaluated as different latent constructs: the two-phase OLS models clarify the main transmission sequence (Brent crude → plastic manufacture → food PPI), while the ETB framework is used to examine the exposure, transmission and buffering mechanisms associated with the estimated relationship.

Logistics risk models are an extension of the prior models by incorporating transportation, inventory and cold-chain hazards. The risk assessment in multi-echelon systems, like cold-chain packaging where temperature excursions damage the polymer performance, is analysed by Bayesian networks, fuzzy logic and system dynamics (SD) models (Lion & Johlitz, 2026). These models often break threats down into external (geopolitical), supply (feedstock), and logistical (delays, chokepoints) layers which reflect ETB components. Together with Ripple Effect models, they analyse propagation under various stressors. Various types of food-grade polymers are utilized in food packaging and related fields. These include polyethylene terephthalate (PET), high-density polyethylene (HDPE), low-density polyethylene (LDPE), polypropylene (PP), and specialized variants such as hydroxypropyl methylcellulose (HPMC) and methylcellulose (MC) for stabilization. When it comes to packaging food and drink, they are crucial for both safety and compliance (Verma & Gupta, 2021). Such materials must be compliant to stringent migration limitations such as Generally Recognized as Safe (GRAS) standards and regulatory criteria such as EU 10/2011 equivalents or Malaysian standards to ensure that chemicals are not leached (Gupta et al., 2024). Disruptions exacerbate risks in this

market. Variations in upstream feedstocks impact polymer synthesis, making it more costly and restricting the availability of new and recycled materials that are safe for food. Recycled food-grade polymers also encounter additional hurdles like contamination risk, increasing manufacturing costs and traceability requirements for food-contact compliance. Study indicates that food-grade Recycled Polyethylene Terephthalate (rPET) is more expensive than virgin counterparts, particularly during shocks (Tumu et al., 2024). A main interruption, like a petrochemical shortage, leads to a ripple effect, increasing noncompliance, product recalls, or more expensive alternatives in midstream polymer extrusion and downstream packaging conversion (Louw & Pienaar, 2011). Malaysian industry is facing these changes as it produces and exports a lot of plastics. Most plastics used in local business are for food packaging, but the standards for recycling for food-grade application make circular buffering more difficult. The integration with ETB indicates that food safety-critical polymers are more vulnerable to price and availability shocks when exposed to many imported feedstocks. This buffering requires investing in local recycling infrastructure, certification and a broad array of suppliers to make sure they are compliant through the waves.

From the literature, although Ripple Effect provides a framework for understanding cascading disruptions and ETB framework offers a useful lens for interpreting how shocks are absorbed and propagated, limited empirical evidence directly examines the association between changes in Brent crude oil prices and Malaysian plastic manufacturing and the food PPI transmission sequence in the context of the 2026 Strait of Hormuz episode. Additionally, studies on food-grade polymers have extensively examined chemical migration and regulatory compliance risks, but limited attention has been given to whether a geopolitical energy shock is statistically associated with domestic plastic manufacturing and food-price indicators.

Methodology

This is an empirical quantitative study and uses monthly time series data and two sequential OLS regression models. The research design quantifies connections along a suggested transmission sequence in the supply chain without making causal claims. The Ripple Effect Model prescribes the pathway of propagation from upstream to downstream, whereas the ETB framework interprets the mechanisms of exposure, transmission, and buffering. The study examines the March 2026 geopolitical disruption caused by the reported closure and severe restriction of commercial transit through the Strait of Hormuz, using secondary data observations as pre-event and post-period context (Rasmussen & Ghosh, 2026).

Data Sourcing and Variable Selection

This empirical analysis employs 37 monthly observations from July 2023 to July 2026. Brent crude oil is the upstream international energy-price variable. Industrial and producer-price data are available in the Department of Statistics Malaysia (DOSM) data repository. The variables represent the upstream energy of the proposed sequence of transmission, the domestic production of plastic, and the downstream food-product costs.

Independent variable X_1 is Brent crude oil price (USD/bbl), which is observed monthly in the study dataset used as an upstream global price indicator for hydrocarbons. The DOSM Production of Plastic Products Index (code 222) serves as the intermediate variable X_2 (Plastic Manufacturing Index) representing the domestic plastic manufacturing stage in the planned transmission chain. Y is the dependent variable and is the DOSM Producer Price Index for food

products, reflecting price changes at the downstream food manufacturing stage. In Phase 2, Y is modeled as a function of the plastic manufacturing index and Brent crude oil price. The variable captures producer price movements and should not be interpreted as a direct measure of retail food inflation or household food prices.

Model Specification (Ordinary Least Squares Regression)

To examine the proposed sequential transmission pathway, the study estimates two separate bivariate OLS models rather than one multivariable equation. OLS is appropriate here as a transparent descriptive method for estimating the linear association between continuous monthly variables and for quantifying the two links in the proposed sequence. In particular, the estimates are interpreted as associations rather than causal effects.

Phase 1: Upstream Cost Transmission Model

The first phase models the impact of global energy shocks (X_1) on the midstream plastic packaging industry (Y_{Plastic}):

$$Y_{\text{Plastic},t} = \beta_0 + \beta_1(X_{1,t}) + \epsilon_{1,t}$$

Where

$Y_{\text{Plastic},t}$ = Index of plastic manufacture at month t

$X_{1,t}$ = Brent Crude Oil Price (USD/bbl) at month t

β_0 = Intercept (baseline manufacturing cost index independent of oil prices)

β_1 = Regression coefficient measuring the sensitivity of local plastic costs to global oil fluctuations

$\epsilon_{1,t}$ = Stochastic error term for Phase 1 at month t

Phase 2: Downstream Cost Cascade Model

The second phase tracks the secondary ripple effect, shifting the index of plastic manufacture (X_2) into the predictor position to estimate its downstream cost transmission to the producer price index of food products (Y_{Food}):

$$Y_{\text{Food},t} = \alpha_0 + \alpha_1(X_{2,t-2}) + \alpha_2(X_{1,t-2}) + \epsilon_{2,t}$$

Where

$Y_{\text{Food},t}$ = Producer price index (PPI) of food products at month t

$X_{2,t-2}$ = Index of plastic manufacture at month $t-2$

$X_{1,t}$ = Brent Crude Oil Price (USD/bbl) at month $t-2$

α_0 = Phase 2 Intercept (baseline food producer price index independent of plastic packaging shifts)

α_1 = Regression coefficient measuring the transmission rate of packaging inflation to food product pricing

$\epsilon_{2,t}$ = Stochastic error term for Phase 2 at month t

In addition to the two OLS models, the study examines the March 2026 observation as an event-period anomaly and conducts an exploratory lag analysis. The purpose is to assess

whether the large movement in the upstream energy-price series was accompanied immediately or with a delay by changes in the domestic plastic-manufacturing and food-price indices.

Econometric Estimation and Diagnostic Validation

All statistics and OLS estimations were performed in EViews. Work file data was a monthly time series. Statistics provided are coefficients, standard errors, t-statistics, p-values, R^2 , and adjusted R^2 . An econometric diagnostic test was conducted in EViews to assess the reliability of the OLS estimates and minimize the risk of spurious regression and invalid statistical inference. Augmented Dickey-Fuller (ADF) was used for testing data stationarity, and Breusch-Godfrey LM for serial correlation and heteroskedasticity via Breusch-Pagan-Godfrey BP. Newey-West HAC standard errors were employed to obtain robust inference, and the Chow Breakpoint Test was used to identify the structural break around March 2026. Goodness-of-fit: R^2 and adjusted R^2 reflect the percentage of the dependent variable variation explained by the single predictor in each bivariate model. Two-tailed t-tests and p-values evaluate slope coefficients for coefficient hypothesis testing.

Results

This section reports the empirical findings from the two-phase OLS analysis. From the diagnostic validation test, data became stationary after first differencing at the 1% significance level, confirming that the series are integrated of order one (I(1)). Although the residual diagnostics identified serial correlation (Breusch-Godfrey LM = 28.7756, ($p < 0.001$)) and heteroskedasticity (Breusch-Pagan-Godfrey BP = 7.4334, ($p = 0.0064$)), under the Newey-West HAC adjustment, the two-month lagged coefficient remained statistically significant at the 10% level ($\beta_1 = -0.8175$), ($t = -1.7680$), ($p = 0.0771$)). Finally, the Chow Breakpoint Test identified a statistically significant structural break around March 2026 ($F = 47.0728$), ($p < 0.0001$)), indicating a change in the relationship between the variables around the period of the maritime disruption.

The results show that there are two statistical relations that are in line with the predicted Ripple Effect sequence: Brent crude oil price and Malaysia's plastic manufacture index and food-product PPI. Results are interpreted with ETB. The exploratory two-month lag and March 2026 event-period observation are considered separately because they do not prove causality.

Phase 1: Upstream Raw Material Cost Transmission (Brent Crude Oil → Index of Plastic Manufacture)

At the upstream Phase 1, the energy price variance explains 47.36% of the variance in Malaysia's Index Plastic Manufacture. The global crude oil spot prices demonstrate a positive, statistically significant association with domestic plastic manufacturing costs ($\beta = 0.1141$, $t = 5.611$, $p < 0.001$); hence, a US\$10 per barrel surge in Brent crude oil is associated with a 1.14-point increase in the domestic plastic manufacturing index. This fits with the upstream exposure route but does not prove that oil prices alone drive plastic-manufacturing costs or that the geopolitical event of March 2026 was the cause of the change.

Table 1: OLS Regression Brent Crude Oil Price and Index of Plastic Manufacture)

Independent Variable (IV)	Coefficient (β)	Std. Error	t-stat	p-value	Significance Level
Constant	104.4383	1.6340	63.909	0.0001	Significant
Brent Oil Price (X_1)	0.1141	0.0203	5.611	0.0001	Significant

Phase 2: Downstream Cost Transmission to Consumer Goods (Index of Plastic Manufacture → PPI Food Products)

In Phase 2, evaluating supply chain transmission via a 2-month lag proves that packaging cost variance explains 39.94% of the variance in downstream finished food producer prices ($\beta = -1.7160$, $p < 0.00006$), while $R^2 = 0.3994$. However, the negative coefficient should thus be interpreted with caution. The finding does not suggest that higher costs for packaging lower prices of food or affect how food is priced. The negative coefficient in the 2023-2026 sample could be due to common trends, unobserved variables, or macroeconomic concerns, i.e., the energy costs, exchange-rate fluctuations, agricultural input prices, labour expenses, and inflation.

Table 2: OLS Regression Index of Plastic Manufacture and PPI Food Products

Independent Variable (IV)	Coefficient (β)	Std. Error	t-stat	p-value	Significance Level
Constant	307.3243	39.1200	7.856	<0.0001	Significant
Brent Oil Price (X_1) (Lag t-2)	0.1927	0.0567	3.396	0.00183	Significant
Index of Plastic Manufacture (X_2) (Lag t-2)	-1.7160	0.3722	-4.610	0.00006	Significant

March 2026 Event-Period Observation and Exploratory Lag Analysis

Figure 1 illustrates the OLS across time delays ranging from Lag 0 (same month) to Lag 4. At lag 2, model fit began to rise significantly, which identifies 2 months as the statistical transmission window across the supply chain. In Lags 3 and 4, the R^2 values rise further at extended lags, reflecting the long-term macro trend co-movements rather than acute shock transmission. In Figure 2, during the acute March 2026 event window ($t=0$), global Brent crude oil prices spiked immediately from USD 72.87 to USD 118.35 per barrel and maintained at more than USD 100, which subsequently triggered a 1-month delayed pass-through ($t+1$) in the plastic manufacture index as it rose from 110.2 in February to 115.4 in April and 116.8 in May, ultimately driving a 2-month downstream ripple ($t+2$) where the producer price index for food products surged from a flat baseline of 130.7 in March to 135.8 in June before peaking at 136.2 in July 2026.

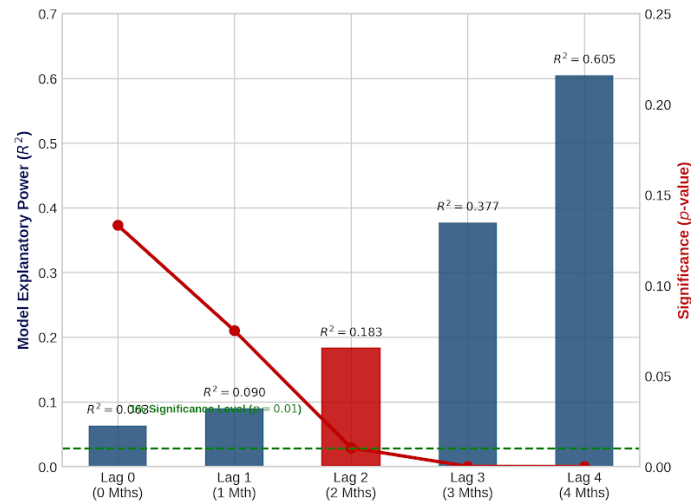


Figure 1: Explanatory Power R^2 Across Lag Horizons

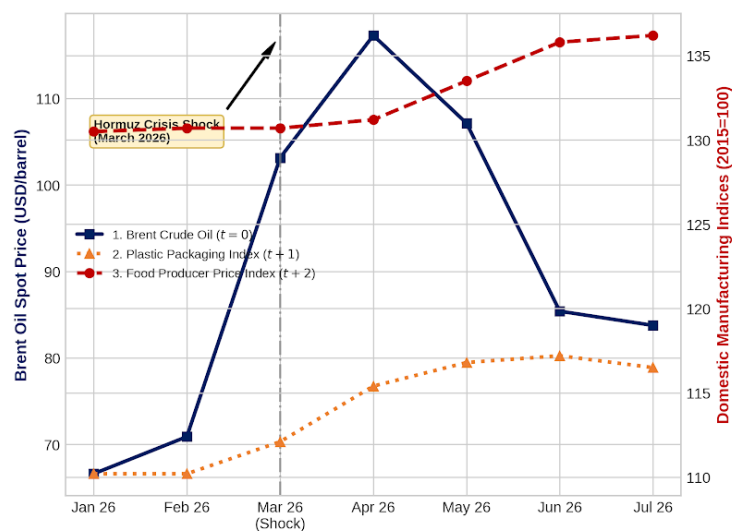


Figure 2: March 2026 Event Period Transmission

Discussion

The two-phase findings provide quantitative evidence of connections along an upstream-to-downstream sequence but do not prove causality. ETB helps explain exposure, transmission, and buffering mechanisms, while the Ripple Effect Model illustrates how a disruption can ripple across the supply chain.

Deconstructing the Upstream Shock: The Hydrocarbon-to-Polymer Conduit

The coefficient for Phase 1 ($\beta = 0.1141$, $t = 5.611$, $p < 0.001$) shows that Brent crude oil prices are positively related to the Malaysia's plastic-manufacturing index. The exposure part of the ETB framework shows that the domestically manufactured goods indicator reflects changes in an internationally traded energy input. At 47.36%, global crude oil becomes the predominant driver model of domestic plastic manufacturing costs. Nearly half of the cost volatility in Malaysia's packaging sector is directly controlled by global energy prices.

A disruption affecting the Strait of Hormuz can reduce or restrict seaborne hydrocarbon flows and place pressure on global energy and petrochemical markets. In March 2026, major shipping companies suspended or rerouted services following the reported closure and severe restriction of commercial transit through the strait (Rasmussen & Ghosh, 2026). Because plastics are produced from hydrocarbon feedstocks through processes including naphtha cracking, changes in crude and petrochemical prices can be transmitted to polymer production costs (Lyu et al., 2014). The present regression supports an association between the global energy-price indicator and Malaysia's plastic-manufacturing index, but it does not estimate the causal effect of the Strait of Hormuz event itself.

The Downstream Cascading Effect and the Paradoxical Negative Coefficient

The Phase 2 model reports a statistically significant negative coefficient ($\beta = -1.7160$, $p < 0.00006$). The $R^2 = 39.94\%$ shows the variation in the food-product PPI is accounted for statistically by the plastic-manufacturing index and Brent oil; however, it does not mean that packaging costs explain the 39.94% of food-price changes in a causal sense. The inverse coefficient also means that the model cannot be used to claim that packaging-cost increases raise food-product prices. The result is better understood as evidence of a strong contemporaneous association that may reflect broader macroeconomic trends and omitted variables. The negative coefficient is therefore an important qualification rather than evidence of a conventional positive packaging-cost pass-through. The 2023–2026 period includes changes in exchange rates, energy prices, agricultural inputs, labour costs, and other inflationary conditions that are not explicitly controlled in the bivariate model. Future analysis should consider a multivariable time-series specification and appropriate stationarity/cointegration testing before making stronger claims about downstream cost transmission.

Logistics Lag Time and Corporate Buffering: Socio-Chemical Compromises-Food Grade Polymer Integrity and Food Safety

Brent crude increased sharply in the event period, coinciding with an increase in the domestic plastic manufacturing index. In contrast, the food PPI remained unchanged in March before increasing from April onward, suggesting that the plastic manufacturing sector exhibits a more immediate response, whereas price movements in food products appeared with a longer temporal lag.

This temporal difference is consistent with the ETB concept of buffering through inventories, contracts, and other operational mechanisms, but the present dataset does not directly observe firms' inventory levels or contract terms. Therefore, the buffering explanation is interpretive rather than directly estimated. Meanwhile, food-grade packaging introduces safety considerations that are distinct from the economic price relationship. The supply constraints and price pressures can increase compliance risks when companies use alternative products that lack food contact certification. The risks relevant to this study are chemical migration from packaging into food, contamination of food-contact materials, non-conforming recycled inputs and loss of traceability or regulatory compliance. Migration reviews of packaging material show that the migration of chemicals into food is dependent on the material composition, contact conditions, and features of food (Gupta et al., 2024). Toxicological thresholds and intentionally and non-intentionally added chemicals are especially relevant for the use of recycled post-consumer polyolefins for food packaging (Tumu et al., 2024).

Study Limitations

The empirical design has several limitations. Bivariate regression models with 37 monthly observations may affect coefficients due to omitted variables and shared time trends. The analysis does not directly measure firm-level inventories, procurement contracts, container freight rates, or food-safety incidents. The two-month lag is exploratory, and the study does not use a causal identification strategy that isolates the effect of the Strait of Hormuz event from other contemporaneous macroeconomic shocks. Accordingly, the results should be interpreted as evidence of statistical association and as a basis for further supply-chain and policy research rather than as estimates of a causal geopolitical effect.

Conclusions and Recommendations

This study examines the relationship between a global energy-price indicator, Malaysia's plastic-manufacturing index, and the food-product PPI using 37 monthly observations from July 2023 to July 2026. The March 2026 geopolitical disruption is treated as the event period, with the reported closure and severe restriction of commercial transit through the Strait of Hormuz providing the contextual shock. The two-phase OLS results show a statistically significant positive association between Brent crude oil price and the plastic-manufacturing index, while the second model shows a statistically significant inverse association between the plastic-manufacturing index and food-product PPI. These findings support discussion of a potential propagation pathway but do not establish causality.

The study also identifies a food-safety dimension that is relevant to supply-chain resilience. Material suitability, traceability, chemical migration, and contamination must be controlled in food-contact packaging. The literature indicates that changes in material composition and the use of recycled polymers require careful assessment of food-contact safety (Gupta et al., 2024; Tumu et al., 2024). The empirical analysis does not measure actual chemical migration events in Malaysia, so these safety issues are presented as risk pathways rather than observed outcomes of the March 2026 disruption.

To mitigate these cascading geopolitical risks and secure national food safety, a coordinated, multi-stakeholder response is required. The following strategic interventions are proposed:

1. Dual sourcing and supplier diversification: The Phase 1 association indicates that Malaysia's plastic-manufacturing index is sensitive to movements in the global Brent price, while the March 2026 shipping disruption demonstrates the operational importance of alternative routes. A dual- or multi-sourcing strategy can therefore be examined as a buffering measure under the ETB framework, particularly for critical food-grade inputs. Any quantitative sourcing target, such as a maximum share from one region, should be based on firm-level supply-chain data rather than imposed from the present regression results.
2. Strengthening food-grade polymer compliance: The food-safety literature identifies chemical migration, contamination, material suitability, and traceability as key concerns. The relevant authorities and industry participants should therefore maintain or strengthen documented food-contact certification, migration testing, traceability, and verification procedures, especially when alternative or recycled materials are introduced during supply shortages. This recommendation follows from the identified

risk pathway; the present study does not demonstrate actual regulatory non-compliance during the March 2026 event.

3. Developing closed-loop food-grade recycling capacity: Literature shows that recycled polymers for food contact require contamination control, traceability, and compliance assessment. Recycling that is certified as food grade could cut dependence on virgin resin during supply disruptions. While the paper does not estimate the cost-effectiveness of the recommendation, it is based on the study's exposure and buffering framework.
4. Adaptive inventory and logistics planning: Two-month exploratory cross-correlation suggests domestic indices may lag initial upstream shock. Inventory controls and scenario design can be used by firms to test delayed transmission. In logistics, rerouting around the Cape of Good Hope can add 10-15 days to transit delays on the affected routes (Global Cold Chain Alliance, 2026). This study should not be used to calibrate the two-month inventory buffers of Malaysian enterprises. Firm-level lead time and inventory data are needed.

Overall, the empirical findings include diversifying important inputs, maintaining food-grade compliance while substituting materials, improving traceability and recycling, and including delayed-shock scenarios in supply-chain planning. The significant Brent-plastic association identifies upstream exposure, the food-contact literature identifies material-safety risks, and the exploratory lag analysis suggests shock transmission may be temporally delayed. Data on sourcing, inventory, freight rates, and food-safety incidents is needed for stronger policy or firm-level prescriptions.

-
- Acknowledgements:** The authors express sincere gratitude to the Faculty of Business and Management, Universiti Teknologi MARA Perak Branch, for providing the essential resources and institutional support throughout this research project. We also extend our sincere appreciation to our colleagues and peers for valuable feedback and continuous encouragement, which substantially contributed to the refinement of this research.
- Funding Statement:** No Funding
- Conflict of Interest Statement:** The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have contributed to this work and approved the final version of the manuscript for submission to the International Journal of Law, Government and Communication (IJLGC)
- Ethics Statement:** This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards.
- Author Contribution Statement:** All authors contributed significantly to the development of this manuscript. [Farrah Dina Abd Razak and Nor Samsinar Kamsi] was responsible for the conceptualization, methodology, and overall supervision of the study. [Nor Marini Mohtar and Mohd Akmal Sobari] handled data collection, analysis, and interpretation of results. [Nor Samsinar Kamsi and Radin Firdaus Radin Badarauddin] contributed to the literature review, drafting, and critical revision of the manuscript. All authors read and approved the final version of the manuscript prior to submission
- Declaration on the Use of Artificial Intelligence (AI)** “The author(s) declare that generative AI or AI-assisted technologies were used during the preparation of this manuscript. The following tools were used: QuillBot, Gemini, and ChatGPT. QuillBot was used for language editing and grammar improvement, while Gemini and ChatGPT were used to support the assessment and synthesis of the literature and the development of the study framework. All AI-assisted outputs were critically reviewed, evaluated, and verified by the author(s), who take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.”
-

References

- Department of Statistics Malaysia [DOSM]. (2026). Monthly Producer Price Index (PPI) for Plastic Manufacturing (Code C222) and Food Products (2010=100) [Data File]. OpenDOSM Data Catalogue. <https://open.dosm.gov.my/data-catalogue/ppi>
- Dolgui, A., Ivanov, D., & Sokolov, B. (2018). Ripple effect in the supply chain: An analysis and recent literature. *International Journal of Production Research*, 56(1–2), 414–430. <https://doi.org/10.1080/00207543.2017.1387680>
- Ghadge, A., Wurtmann, H., & Seuring, S. (2020). Managing climate change risks in global supply chains: A review and research agenda. *International Journal of Production Research*, 58(1), 44–64. <https://doi.org/10.1080/00207543.2019.1629670>
- Ghadge, A., Er, M., Ivanov, D., & Chaudhuri, A. (2022). Visualisation of ripple effect in supply chains under long-term, simultaneous disruptions: A system dynamics approach. *International Journal of Production Research*, 60(20), 6173–6186. <https://doi.org/10.1080/00207543.2021.1987547>
- Global Cold Chain Alliance. (2026, May 20). *Middle East conflict disruption updates & situation report – May 20, 2026*. <https://www.gcca.org/news-announcements/middle-east-conflict-disruption-updates-situation-report-may-20-2026/>
- Gupta, R. K., Pipliya, S., Karunanithi, S., Eswaran U, G. M., Kumar, S., Mandliya, S., Srivastav, P. P., Suthar, T., Shaikh, A. M., Harsányi, E., & Kovács, B. (2024). Migration of chemical compounds from packaging materials into packaged foods: Interaction, mechanism, assessment, and regulations. *Foods*, 13(19), Article 3125. <https://doi.org/10.3390/foods13193125>
- Ivanov, D., Sokolov, B., & Dolgui, A. (2014). The ripple effect in supply chains: Trade-off "efficiency-flexibility-resilience" in disruption management. *International Journal of Production Research*, 52(7), 2154–2172. <https://doi.org/10.1080/00207543.2013.858836>
- Kenanga Research. (2026, July 15). *Plastic packaging: 3Q26 strategy* [Sector update]. Kenanga Investment Bank Berhad. <https://www.kenanga.com.my/wp-content/uploads/2026/07/Plastic-Packaging-260715-3Q26-Strategy-Kenanga.pdf>
- Lion, A., & Johlitz, M. (2026). Modelling of temperature-related phenomena in polymers. *Acta Mechanica*. <https://doi.org/10.1007/s00707-026-04652-2>
- Louw, J. J., & Pienaar, W. J. (2011). Framework for advanced supply chain planning: Large-scale petrochemical companies. *Corporate Ownership & Control*, 8(3–4), 452–463. <https://doi.org/10.22495/cocv8i3c4p3>
- Lyu, B., Kwon, H., Lee, J., Yoon, H., Jin, J., & Moon, I. (2014). Forecasting of naphtha demand and supply using time serial data causal analysis. In *Computer Aided Chemical Engineering* (Vol. 33, pp. 829–834). Elsevier. <https://doi.org/10.1016/B978-0-444-63456-6.50139-3>
- Patsiaouras, G., Saren, M., & Green, P. (2026). Geopolitical risk and international business: A multi-disciplinary review and research agenda. *The Multinational Business Review*, 1–24. <https://doi.org/10.1108/mbr-06-2025-0204>
- Rasmussen, L., & Ghosh, K. (2026, March 1). Shipping companies divert vessels around Cape of Good Hope after strikes on Iran. Reuters. <https://www.reuters.com/world/middle-east/maersk-pauses-sailings-through-suez-canal-bab-el-mandeb-strait-citing-escalating-2026-03-01/>
- Sangwa, S., & Murungu, E. (2026). Strait of Hormuz disruption, Africa–Asia trade linkages, and policy options for African states. *Open Journal of Stewardship Economics & Ethical Innovation*, 2. <https://doi.org/10.65655/OpenChristianPress.2026.98>

- Tumu, K., Vorst, K., & Curtzwiler, G. (2024). Understanding intentionally and non-intentionally added substances and associated threshold of toxicological concern in post-consumer polyolefin for use as food packaging materials. *Heliyon*, 10(1), e23620. <https://doi.org/10.1016/j.heliyon.2023.e23620>
- U.S. Energy Information Administration [EIA]. (2026). Europe Brent Spot Price FOB (Monthly USD per Barrel) [Data File]. Short-Term Energy Outlook Data Portal. <https://www.eia.gov/outlooks/steo/>
- Verma, M. K., & Gupta, A. (2021). Trends in packaging material for food products. *Journal of Applied and Natural Science*, 13(Special Issue), 248–255. <https://doi.org/10.31018/jans.v13iSI.2800>