

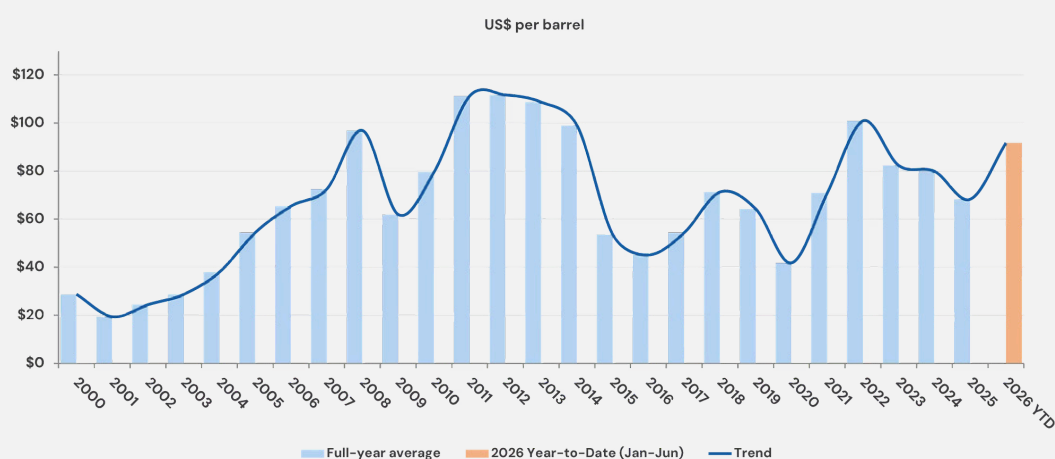
Tracing How Energy Price Shocks Ripple through Singapore's Industries Using Input-Output Analysis

by Priscilla Lim and Bradford Loh
Input-Output Tables Division
Singapore Department of Statistics

Introduction

Changes in crude oil prices can have effects well beyond the Energy sector. As industries purchase inputs from one another, higher oil prices can ripple through supply chains, raising transport and distribution costs for businesses and ultimately consumers. As a highly interconnected economy with limited domestic energy resources, Singapore relies heavily on energy imports. Crude oil and refined petroleum products are key inputs to refining, petrochemicals, transport and manufacturing, in addition to their use as fuels. As Chart 1 shows, oil prices can also fluctuate sharply over time.

Chart 1: Brent Crude Oil Price (USD), 2000 – Jun 2026



Source: U.S. Energy Information Administration, Europe Brent Spot Price FOB.

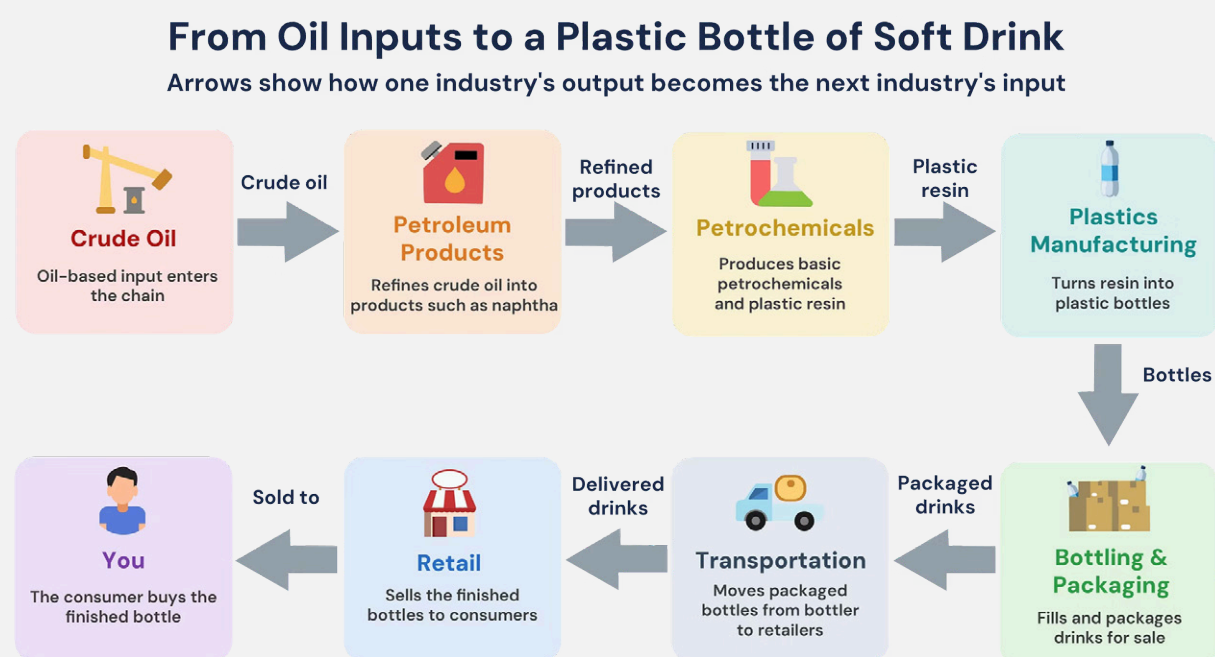
This article examines how higher oil prices can affect different industries in Singapore using the Supply, Use and Input-Output Tables (SU-IOTs). It illustrates the direct impact of a simulated 10% increase in imported petroleum prices on the Petroleum Products industry, and how the same framework can be used to understand broader supply-chain effects. The method can also be applied proportionally to analyse price shocks of varying magnitudes.

Concepts & Methodology

SU-IOTs and Their Applications

As an illustration, consider the production of a plastic bottle of soft drink. Refined petroleum products such as naphtha are processed into petrochemical products, then plastic resin, which is moulded into bottles, filled and packaged before being sold to consumers. At each stage, one industry purchases inputs from another, illustrating production linkages captured in SU-IOTs (Figure 1).

Figure 1: From Oil Inputs to a Plastic Bottle of Soft Drink



When the price of crude oil rises, the impact can extend beyond refineries as higher input costs spill over to interconnected production chains and affect downstream industries.

SU-IOTs help trace these linkages by mapping out who buys what from whom. Supply and Use Tables (SUTs) show how goods and services are produced, imported and used in the economy, while Input-Output Tables (IOTs), derived from the SUTs, show how industries are connected through their purchases and sales.

The Leontief price model is applied to estimate how an input price shock propagates through these linkages by capturing:

Direct Effects

Higher costs for industries that purchase the affected input directly

Indirect Effects

Higher costs for downstream industries that source from impacted suppliers

The sum of direct and indirect effects reflects the **total impact** of the price shock.

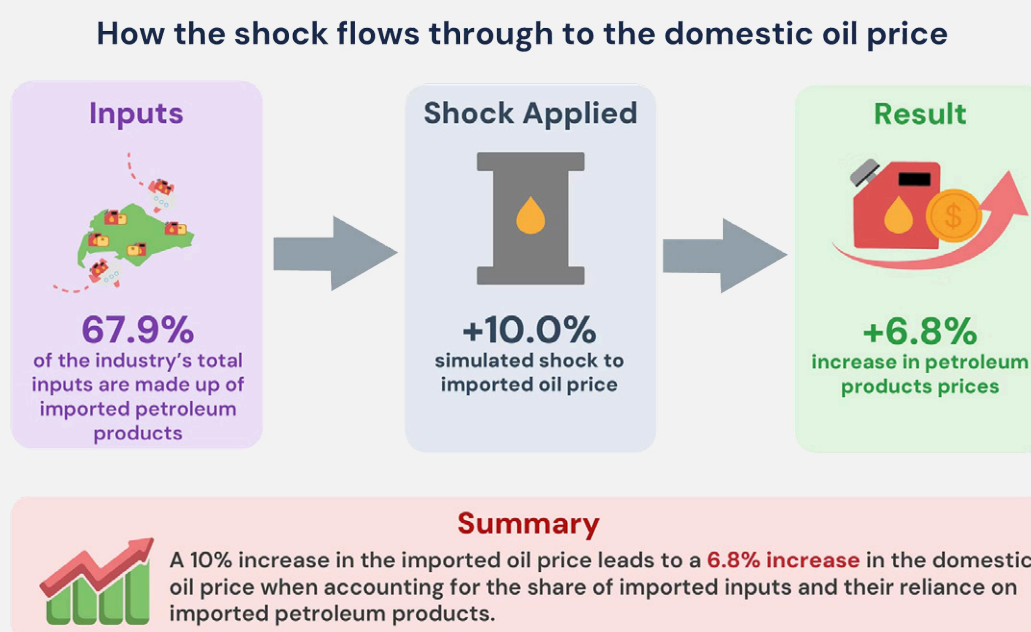
The Leontief price model is a structural analysis tool rather than a forecast. It assumes that industries maintain the same input mix after the price shock and fully pass on higher input costs. Therefore, it does not capture adjustments such as absorbing costs through profit margins, switching suppliers, changing production processes or altering the output mix. The model is useful for identifying where cost pressures may arise across the economy, but more sophisticated models are needed to assess how businesses may respond in practice.

Findings

Direct Impact of an Imported Oil Price Shock

The simulation begins with the Petroleum Products industry, which is most directly exposed to the shock. In the 2023 SU-IOTs, imported petroleum products, mainly crude oil, accounted for 67.9% of the Petroleum Products industry's inputs. If imported petroleum prices were to increase by 10%, the direct impact is a 6.8% increase in the output prices of the Petroleum Products industry, assuming the increased cost is fully passed through (Figure 2).

Figure 2: Direct Impact of a 10% Price Increase in Imported Oil on Output Prices in Singapore's Petroleum Products Industry



As 67.9% of the industry's total inputs are imported petroleum products, a 10% increase in the cost will translate into a broadly proportionate increase in the industry's modelled output price.

For comparison, Brent crude oil rose about 10% between January and October [1] in 2023 while the average retail price of 95 octane petrol in Singapore increased 6.6% [2] over the same period.

The increases are not directly comparable. The 6.8% increase reflects the broader industry's modelled output price, whereas retail petrol prices carry other cost components and business considerations. Nonetheless, the trends move in the same direction and by a broadly similar magnitude. The SU-IOTs therefore provide a structured way to estimate how import price shocks may affect prices across Singapore's industries.

How the Price Shock Ripples Further

Beyond the direct effect on petroleum products shown in Figure 2, SU-IOTs also show how a price shock can propagate through the economy (Figure 3).

The Transport industry feels the impact relatively quickly as they directly rely on petroleum-linked products in its day-to-day operations. An industry that does not purchase petroleum may source inputs from industries that do, building cost pressures in the goods and services purchased. This pathway is best traced structurally via the SU-IOTs.

[1] [U.S Energy Information Administration \(EIA\), Europe Brent Spot Price FOB](#)

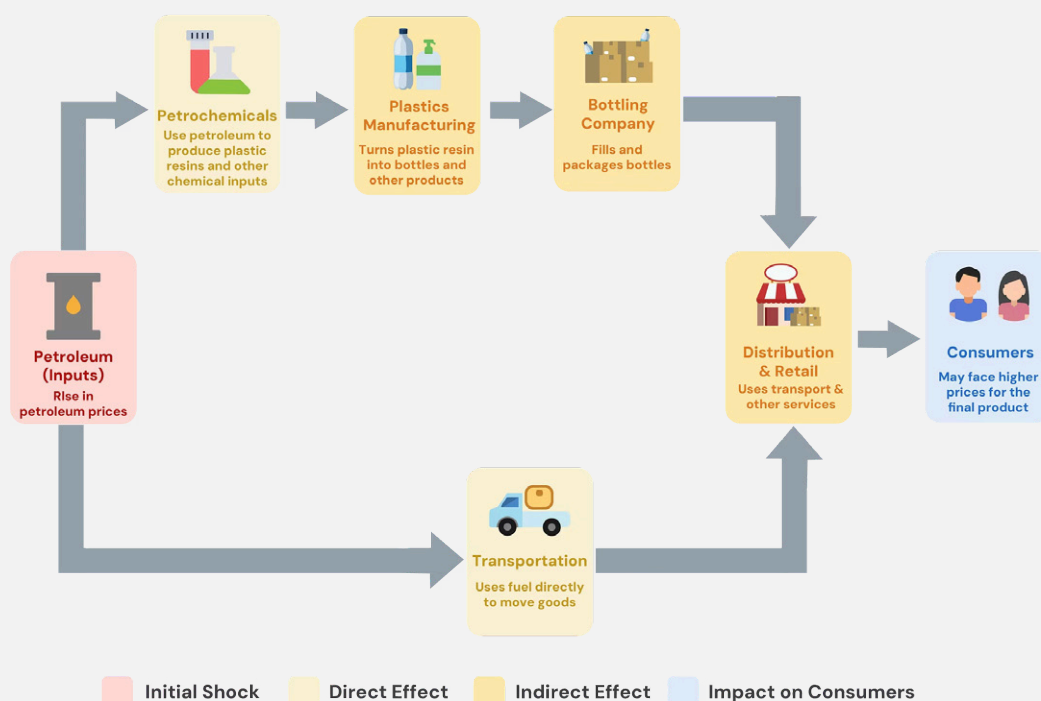
[2] [Singapore Department of Statistics, Average Retail Prices of Selected Consumer Items](#)

Figure 3: Effects of a Petroleum Price Shock

A rise in imported petroleum prices affects many industries through direct and indirect pathways, which together determine the total impact on consumers.

**Example: Bottled Soft Drink**

Tracing how a rise in petroleum prices reaches consumers through the supply chain for a bottle of soft drink



The ripple effect applies to the wider economy — industries that rely more heavily on transport, materials and logistics tend to see a relatively greater indirect exposure than those that do not. For example,



Food retailers may face petroleum-linked cost pressures through distribution, cold-chain logistics, packaging and imported supplies.



Construction firms may be affected through higher fuel costs for transport, equipment operation, and raw materials.



Service industries are generally less exposed but not immune to petroleum-related cost pressures, which can still spill over indirectly through utilities, outsourced services and supplier costs.

This analysis helps identify where cost pressures are likely to emerge and which industries may warrant closer monitoring when oil prices change. Together, these direct and indirect pathways illustrate how a price shock can spread across Singapore's production network.

Why Real-World Prices may Differ from the Model

Several situations can cause actual prices to diverge from the model's estimates:

Firms may absorb part of the cost increases through **lower profit margins**, pass it on gradually depending on contractual arrangements and demand conditions.

Businesses may **adapt** by switching suppliers, substituting inputs, or improving efficiency.

Final consumer prices reflect more than just the cost of petroleum-linked input costs. Other factors such as labour, rent, logistics, taxes and fees, distribution and business margins play a role too.

Therefore, when an industry faces higher input costs, the eventual price paid by consumers may grow by a different amount, depending on various factors.

Table 1: Leontief Price Model Assumptions vs. Real-World Outcomes

What the model assumes	What happens in practice
Fixed input relationships Industries are assumed to retain the same mix of inputs.	Firms may adjust Businesses can change suppliers, substitute inputs where feasible, or improve processes.
Proportional cost pass-through Higher input costs are assumed to flow through production costs in a consistent way.	Pass-through may vary Some firms may absorb costs, delay price changes, or pass on only part of the increase.
Industry-level output prices The estimate refers to broad industry prices, not a specific consumer item.	Retail prices include more Final prices also reflect labour, rent, logistics, taxes, fees, distribution and margins.
Immediate structural exposure The model shows where cost pressure sits in the production network.	Timing and demand matter Actual prices may depend on contracts, inventories, pricing cycles, competition and demand.

The model estimates are best interpreted as indicators of exposure to the price shock, rather than predictions of actual price movements. The estimates identify which industries are relatively more exposed to the original oil price shock, and whether that exposure primarily stems from direct purchases or through upstream suppliers.

SU-IOTs are useful for this purpose, providing a consistent framework to trace cost pressures across Singapore's production network.

Conclusion

A rise in the price of a key input such as petroleum affects industries both directly and indirectly. Sectors in the Petroleum Products industry that rely on petroleum-related inputs face higher costs first. These pressures then pass through suppliers and the wider production network, with industries such as food retailers and construction typically more exposed than services. A shock to a single input can reach well beyond the industries most directly exposed to it, extending their impact across the wider economy.

SU-IOTs trace these transmission channels by identifying who buys what from whom, and how cost pressures propagate through the production network. Real-world prices will not move exactly as the model suggests, given factors such as existing contracts and market conditions, but the model remains useful for understanding structural exposure to the price shock and why other industries may be affected through supply-chain connections.

By making these linkages more explicit, SU-IOTs provide a comprehensive map of Singapore's production network. Increases in taxi fares, delivery fees and grocery prices are examples of how higher oil prices may affect consumers through supply-chain linkages, which SU-IOTs help to reveal.