

Naphtha and Polyester: A Forensic Investigation into a Fragile Petrochemical Dependency



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The role of naphtha in polyester

Polyester begins not in a spinning mill but in a refinery. Naphtha, a light distillate fraction of crude oil, is the quiet but indispensable feedstock that underpins the entire polyester system. It is not a single molecule but a volatile blend of hydrocarbons in the C5–C10 range, produced whenever crude oil is distilled. Its significance lies in its ability to be cracked, reformed and chemically transformed into the two essential monomers of polyester: monoethylene glycol (MEG) and purified terephthalic acid (PTA).

Empirical studies of the polyester chain consistently show that naphtha prices correlate strongly with PET resin prices, demonstrating a persistent long-run linkage between Brent crude, naphtha, paraxylene (PX) and PTA. This correlation is not incidental; it is the structural backbone of synthetic fibre economics. When naphtha rises, polyester costs rise. When naphtha collapses, polyester margins compress. The fibre is, in effect, a distillate of oil economics.

How refineries create the feedstock

Refineries generate naphtha through atmospheric distillation, where crude oil is separated into fractions by boiling point. Straight-run naphtha emerges early in the column, while additional naphtha streams are produced through catalytic reforming, hydrocracking and coking. These processes alter the molecular structure of hydrocarbons, increasing aromatic content or breaking heavier molecules into lighter ones.

The literature on refinery economics shows that refiners constantly adjust the proportion of naphtha directed to gasoline blending versus petrochemical feedstock depending on relative margins (FGE, 2025). During periods of weak gasoline demand—such as the 2020 pandemic shock—more naphtha is diverted into petrochemical markets, depressing prices and altering the economics of polyester production.

This dynamic means that polyester is not merely tied to crude oil; it is tied to the shifting internal economics of global refining systems.

How naphtha becomes PX and MEG

Once produced, naphtha enters the petrochemical system through two major pathways. In steam crackers, lighter components are thermally cracked at temperatures exceeding 800°C to produce ethylene. Ethylene is then oxidised to ethylene oxide and hydrated to MEG, one of the two monomers required for PET.

Simultaneously, the more aromatic fractions of naphtha are routed to catalytic reformers and aromatics extraction units. These units generate reformate rich in benzene, toluene and xylenes. Paraxylene is separated from mixed xylenes and oxidised to terephthalic acid, which is then purified to PTA.

Polyester is therefore not a single chain but a bifurcated system, with naphtha feeding both halves simultaneously. Any instability in naphtha supply or pricing destabilises the entire fibre economy.

A decade of price shocks and structural shifts

Over the last decade, naphtha prices have traced a volatile arc shaped by crude oil cycles, refinery utilisation, geopolitical conflict and structural overcapacity in Asian petrochemicals.

Between 2014 and 2019, naphtha broadly followed Brent crude, fluctuating within a range consistent with crude at USD 40–70 per barrel. This period was marked by steady polyester demand growth but increasing overcapacity in PX and PTA, particularly in China.

In 2020, the COVID-19 shock caused an unprecedented collapse in crude and refined-product demand. Naphtha prices fell sharply as refineries cut runs and transport fuel consumption evaporated. Yet polyester demand for packaging remained resilient, creating unusual distortions in spreads. PX and PTA prices did not fall as quickly as naphtha, temporarily widening margins before overcapacity reasserted itself.

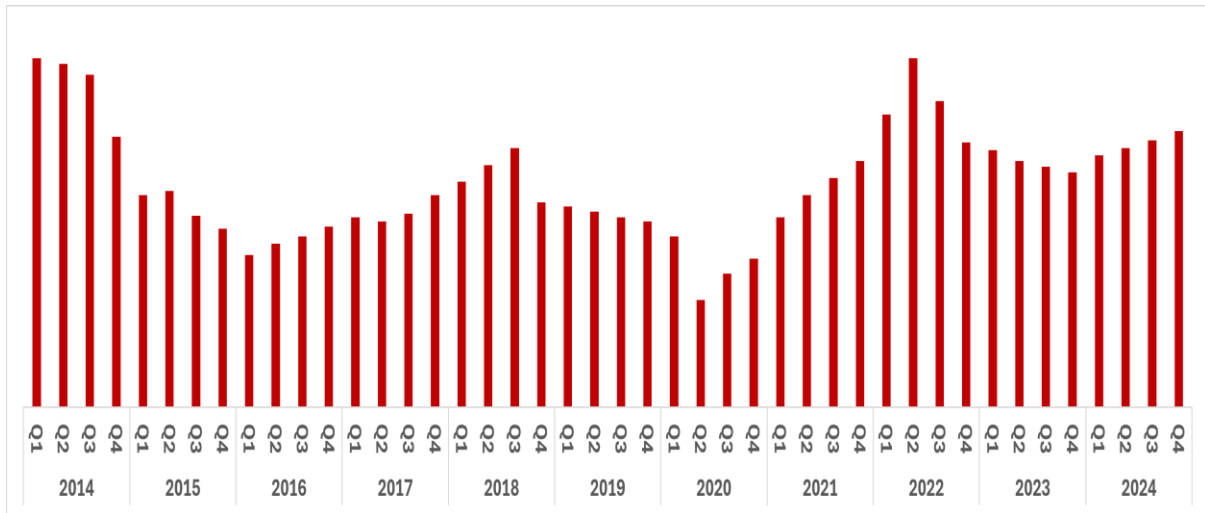
From 2021 to 2022, naphtha rebounded sharply. The Russia–Ukraine conflict tightened global crude markets and disrupted trade flows, pushing naphtha higher and increasing freight costs. Polyester producers faced rising feedstock costs and shrinking margins.

By the mid-2020s, the market had entered a new phase: episodic price spikes driven by geopolitical risk—particularly in the Middle East—combined with long-term downward pressure from weak plastics demand, increased NGL availability and chronic overcapacity in Asian crackers. S&P Global (2026) notes that the polyester chain is now structurally vulnerable to naphtha supply disruptions, especially those affecting flows through the Strait of Hormuz.

The decade-long pattern is one of volatility layered over structural fragility. Polyester has become a fibre whose economics are increasingly unstable.

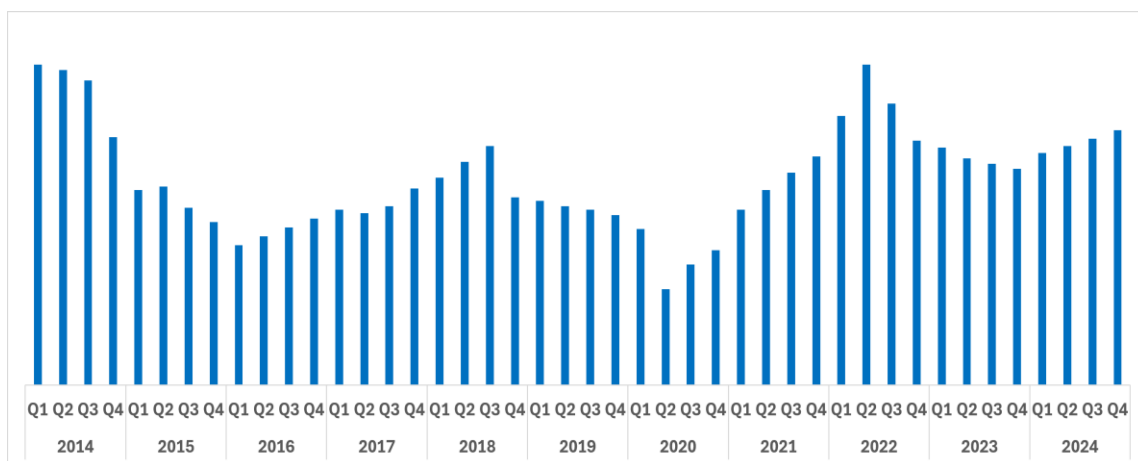


Naphtha Prices (Asia CFR Japan/Singapore), Quarterly 2014–2024. Asia Naphtha 2014–2024: The Volatile Feedstock Behind Polyester



This chart shows the decade-long volatility of Asia’s benchmark naphtha — the primary feedstock for polyester. The steep fall in 2014–2015 reflects the global oil crash, when crude collapsed from over \$100/bbl to below \$40/bbl. The deep trough in 2020 corresponds to the COVID-19 refinery shutdowns and the collapse in transport fuel demand. The dramatic spike in 2022 aligns with the Russia–Ukraine conflict, which tightened global crude markets and disrupted trade flows. The muted recovery after 2023 reveals the structural weakness of the petrochemical sector: overcapacity in Asian crackers, competition from cheaper NGL feedstocks, and declining plastics demand. This is the feedstock that sets the cost floor for polyester — and its instability defines the entire chain.

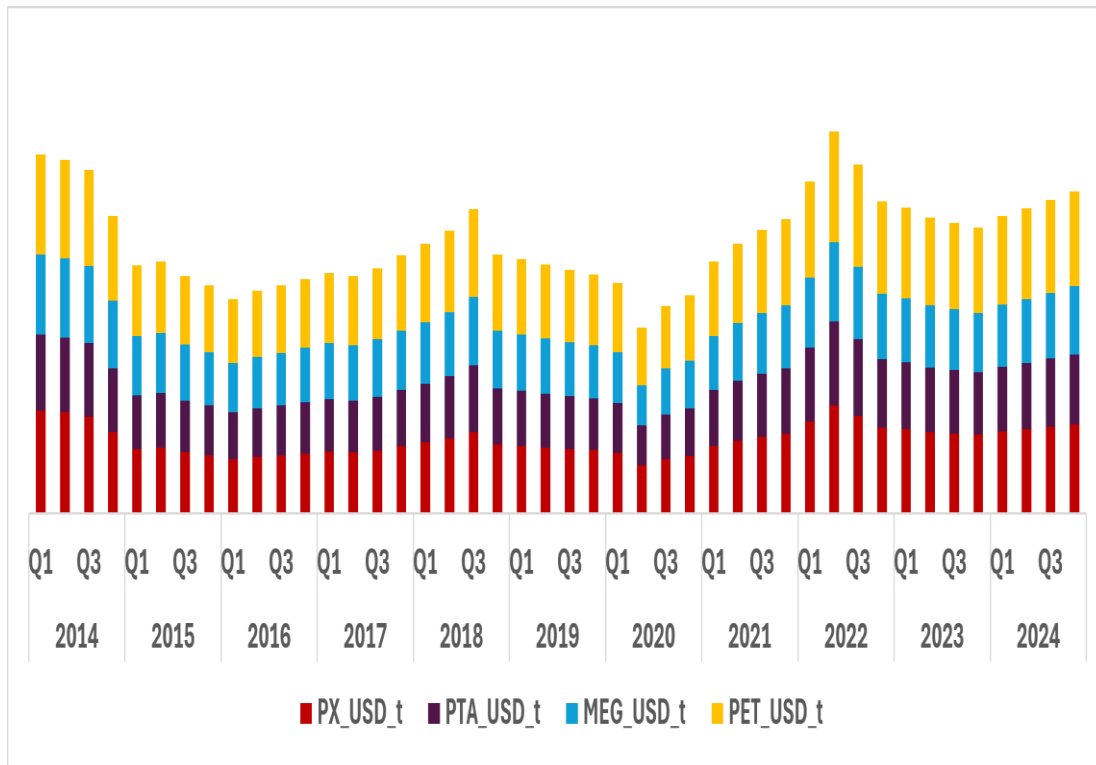
Europe Naphtha (CIF NWE), Quarterly 2014–2024: Europe Naphtha 2014–2024: Refining Economics, Freight Spreads, and Structural Divergence.



This chart captures Europe’s naphtha benchmark, which broadly tracks Asia but with distinct regional behaviour. The 2014–2015 collapse mirrors the global oil crash, but Europe’s recovery was slower due to weak gasoline demand and refinery rationalisation. The 2020 COVID shock pushed European naphtha to multi-year lows as mobility collapsed. The 2022 spike reflects Europe’s acute exposure to Russian crude and refined-product disruptions,

which widened spreads relative to Asia. After 2023, European naphtha stabilises at lower levels, shaped by declining gasoline demand, refinery closures, and increased imports of petrochemical feedstocks. The chart shows how Europe’s refining system — older, more fragmented, and more exposed to policy shifts — produces a different volatility signature from Asia.

PX / PTA / MEG / PET — Asia Benchmarks (Quarterly 2014–2024). Polyester Chain 2014–2024: From Aromatics to Fibre in a Decade of Margin Compression.



This chart shows the full polyester value chain — PX, PTA, MEG and PET — moving through a decade of shocks. PX tracks naphtha closely, rising sharply in 2018 and 2022 during tight aromatics cycles. PTA follows PX but with a dampened response, reflecting chronic overcapacity in China and long-term margin erosion. MEG shows the deepest troughs, especially after 2017, when global MEG capacity surged and NGL-based ethylene undercut naphtha-based production. PET resin reflects the combined influence of PTA and MEG, with sharp declines in 2015 and 2020 and a strong but short-lived spike in 2022. The flattening after 2023 shows how weak textile demand and overbuilt capacity prevent cost pass-through. Together, the lines reveal a chain under structural pressure: volatile feedstocks, oversupply downstream, and shrinking profitability across every stage.

Who controls supply

Naphtha supply is dominated by large refining regions rather than individual companies. The Middle East—particularly Saudi Arabia, the UAE and Kuwait—exports significant volumes of petrochemical-grade naphtha to Asia. Europe and the United States also supply the seaborne market, though their exports fluctuate with gasoline blending economics.

Asia, despite being the world's largest polyester producer, is structurally short of naphtha. China, South Korea and Japan import large volumes to feed their steam crackers and aromatics complexes. This import dependency is a central empirical finding in long-term naphtha outlooks (FGE, 2025), which project that Asia's deficit will deepen as petrochemical capacity continues to expand.

At the corporate level, major integrated players such as Saudi Aramco, ADNOC, Reliance Industries and ExxonMobil produce naphtha as part of their refining slate. Many also operate integrated petrochemical complexes, allowing them to convert naphtha into PX, PTA and MEG internally. This vertical integration gives them strategic control over polyester feedstock pricing and availability.

The empirical evidence from Argus (2024) shows that regional PX price disparities—driven partly by naphtha and refining economics—shape global PTA and PET trade flows. Polyester is therefore not only chemically dependent on naphtha but geopolitically dependent on the regions that control its production.

Major naphtha suppliers and structural power in the polyester chain

The naphtha market is not a neutral backdrop; it is shaped by a small set of powerful refiners, national oil companies and exporting states whose decisions and constraints ripple directly into polyester economics. A forensic look at these actors shows how concentrated, politicised and uneven the feedstock base for polyester really is.

Integrated refiners and petrochemical majors

ExxonMobil sits at the centre of the global naphtha system. With vast refining capacity across North America, Europe and Asia, it produces large volumes of naphtha as part of its gasoline and petrochemical slate. Its deep integration into aromatics and olefins means that a significant share of its naphtha is not sold as a standalone commodity but converted internally into ethylene, PX and downstream derivatives. This gives ExxonMobil a dual role: price-maker in regional naphtha markets and cost-setter for polyester feedstocks via its PX and MEG positions. For polyester buyers, this concentration means that a single corporate balance sheet can influence both the feedstock and the intermediate stages of the chain.

Reliance Industries in India plays a similar structural role but from a different geography. The Jamnagar complex is one of the largest integrated refinery–petrochemical sites in the world, with the ability to swing naphtha between gasoline, aromatics and olefins depending on margins. Reliance can export naphtha, convert it into PX and PTA, or sell downstream PET and polyester. This flexibility gives it significant bargaining power: it can withhold naphtha from the market when petrochemical margins are attractive, or flood the PX/PTA market

when it wants to defend market share. For Asian polyester producers, Reliance is both a competitor and a critical upstream reference point.

Formosa Petrochemical in Taiwan and LG Chem in South Korea illustrate the East Asian model of integrated petrochemical producers that both consume and, at times, supply naphtha. Their refineries and crackers are tightly coupled to domestic and regional demand for PX, PTA, MEG and polymers. In practice, this means that their naphtha flows are less visible as “exports” and more visible as internal feedstock. However, their operational decisions—running rates, maintenance schedules, feedstock switching—have immediate effects on spot naphtha availability in Asia. When these companies cut cracker utilisation due to weak margins, naphtha demand falls and prices soften, feeding back into the economics of polyester elsewhere.

AMOC (Alexandria Mineral Oils Company) in Egypt represents a different kind of player: a regional refiner whose naphtha exports are significant for the Mediterranean and, by extension, for European and some Asian buyers. Its position is more exposed to regional political and logistical risks—Suez Canal dynamics, local energy policy, and North African stability—but its output still feeds into the same global pool that polyester relies on. Forensic analysis of shipment data shows that companies like AMOC, though smaller than ExxonMobil or Reliance, can materially affect regional balances when outages or policy shifts occur.

Alongside these producers, there is a layer of logistics-heavy exporters and traders—such as TRC Environmental Corporation, Bertschi North America and Pluspetrol Peru—who appear prominently in shipment statistics. They may not own the largest refineries, but they control physical flows, storage and distribution. Their role is to arbitrage regional price differences, moving naphtha from surplus regions to deficit ones. For polyester, this trading layer is what makes it possible for Asian crackers to rely on Russian, Middle Eastern or American naphtha without owning upstream assets. It also introduces another layer of fragility: credit risk, freight disruptions and regulatory changes affecting traders can tighten supply even when refining capacity is technically available.

Exporting states and geopolitical leverage

At the country level, Russia has emerged as the single largest exporter of naphtha, shipping tens of millions of tonnes per year and accounting for a substantial share of global seaborne supply. Its exports have increasingly been redirected towards Asia as European sanctions and self-sanctioning reshaped trade flows. This gives Russia significant leverage over Asian petrochemical producers, including polyester chains in China, South Korea and India. Any disruption—sanctions tightening, shipping insurance restrictions, port access issues—can rapidly reprice naphtha and, by extension, polyester feedstocks.

The Gulf states—Saudi Arabia, the UAE, Qatar and Kuwait—form the second major export bloc. Their large, complex refineries produce surplus naphtha that is shipped to Asia and Europe. Unlike Russia, their leverage is tied less to sanctions and more to chokepoints and regional security: the Strait of Hormuz, Red Sea routes, and broader Middle Eastern stability. For polyester, this means that a fibre ostensibly “made in Asia” is structurally dependent on the uninterrupted flow of Gulf naphtha. Any escalation that threatens tanker traffic can trigger immediate feedstock price spikes, as seen in multiple episodes over the last decade.

Europe and the United States are both producers and, at times, exporters of naphtha, but their role is complicated by gasoline blending economics and changing fuel demand. As European gasoline demand declines and refineries close or reconfigure, the region's ability to export naphtha may shrink, tightening global balances. In the US, the rise of NGL-based ethylene has reduced the relative importance of naphtha as a petrochemical feedstock, but refineries still produce it as part of the product slate. For polyester, this means that Atlantic Basin naphtha is increasingly shaped by transport-fuel transitions and climate policy rather than purely by petrochemical demand.

Asia, by contrast, is structurally short of naphtha. China, South Korea and Japan import large volumes to feed their steam crackers and aromatics complexes. This import dependence is the core structural vulnerability of the polyester system: the world's largest polyester production base does not control its primary feedstock. Instead, it relies on a combination of Russian exports, Gulf exports, and Atlantic Basin surplus, all mediated by traders and subject to freight, sanctions and geopolitical risk.

Structural implications for polyester

When you put the corporate and country-level picture together, the polyester chain looks less like a neutral market and more like a system perched on a small set of upstream pillars. A handful of integrated refiners and petrochemical majors decide how much naphtha to sell versus convert internally. A small group of exporting states—Russia and the Gulf producers—control the bulk of seaborne supply. A thin layer of traders and logistics firms stitches the flows together. Downstream, an import-dependent Asia converts this feedstock into PX, PTA, MEG and PET, and then into fibre.

Forensically, this concentration means that polyester is exposed to three overlapping risks. First, corporate strategy risk: when integrated majors choose to prioritise internal conversion or shut capacity, naphtha availability and pricing shift. Second, geopolitical risk: sanctions, conflicts and chokepoint disruptions can remove large export volumes from the market overnight. Third, structural transition risk: as gasoline demand falls and refineries close or retool, the incidental production of naphtha may decline, tightening supply even if petrochemical demand remains.

In other words, the major suppliers of naphtha are not just names on a list; they are the structural gatekeepers of polyester's feedstock. Any serious analysis of polyester's future—economic, environmental or ethical—has to start by acknowledging how much power is concentrated in these companies and countries, and how fragile that makes a fibre the world has come to treat as cheap and abundant.



Why the chain is now structurally fragile

The polyester system is entering a period of heightened instability. Naphtha remains essential, yet its supply is increasingly exposed to geopolitical risk, refining-sector restructuring and competition from alternative feedstocks such as ethane and LPG.

Empirical spread data shows that polyester producers have absorbed much of the volatility rather than passing it downstream. Margins over naphtha for PX, PTA, MEG and PET have trended downward for years, leaving producers financially weakened and more vulnerable to shocks.

S&P Global (2026) warns that even short-term disruptions to Middle Eastern naphtha flows can threaten polyester supply, particularly during seasonal production peaks. The chain's dependence on a single upstream feedstock—one tied to crude oil, refinery economics and geopolitical chokepoints—creates systemic fragility.

Polyester, the world's dominant fibre, is therefore built on a feedstock whose stability can no longer be taken for granted.

Conclusion

A forensic examination of naphtha reveals a feedstock that is both indispensable and increasingly precarious. It is the chemical hinge connecting crude oil to polyester, feeding both the olefins and aromatics pathways that produce MEG and PTA. Over the last decade, its price has been shaped by crude cycles, refinery economics, geopolitical conflict and structural overcapacity in Asian petrochemicals. Empirical evidence from industry analytics shows that polyester margins over naphtha have steadily eroded, leaving the chain exposed to volatility and supply risk.

Polyester's future is therefore inseparable from the future of naphtha. As long as the fibre depends on this volatile distillate, its economics—and its environmental footprint—will remain tied to the shifting dynamics of global oil and refining systems.

Geopolitical conflict model for naphtha and polyester

Polyester's dependence on naphtha is not only chemical but geopolitical. Asia is structurally short of naphtha and relies on imports from Russia, the Gulf states and the Atlantic Basin, all mediated by traders and exposed to chokepoints such as the Strait of Hormuz:

Polyester's vulnerability is not abstract; it can be expressed as a simple conflict-driven feedstock model. By treating geopolitical tension as a shock to naphtha supply, and tracing that shock through PX, PTA, MEG and PET, we can quantify how a tanker incident or sanctions package becomes a margin event for the world's dominant fibre. Any disruption—sanctions tightening, shipping insurance restrictions, port access issues—can rapidly reprice naphtha and, by extension, polyester feedstocks.

Mathematical model linking geopolitical conflict to naphtha prices and, in turn, to polyester economics.

Core variables

Let (t) index time (e.g. quarters from 2014–2024):

- **(G_t): Geopolitical conflict index**
A synthetic indicator of conflict intensity affecting key naphtha routes (e.g. sanctions on Russia, Gulf tensions, Hormuz disruption). Higher (G_t) means greater risk to seaborne naphtha flows.
- **(N_t): Naphtha price**
Benchmark Asia CFR Japan/Singapore (or Europe CIF NWE), as in the charts:

“This chart shows the decadelong volatility of Asia’s benchmark naphtha — the primary feedstock for polyester.”
- **($P_t^{PX}, P_t^{PTA}, P_t^{MEG}, P_t^{PET}$): Polyester chain prices**
Asia benchmarks for paraxylene, purified terephthalic acid, monoethylene glycol and PET resin.
- **(M_t): Polyester margin over naphtha**
An approximate margin measure, such as PET price minus a cost-based function of PX, PTA, MEG and naphtha.

1. Geopolitics → naphtha (supply shock)

We model naphtha as driven by oil, refining and geopolitical risk:

$$N_t = \alpha_0 + \alpha_1 Brent_t + \alpha_2 RefUtil_t + \alpha_3 G_t + \varepsilon_t^N$$

- ($Brent_t$): Brent crude price.
- ($RefUtil_t$): Global refinery utilisation.
- ($\alpha_3 > 0$): captures that higher geopolitical conflict raises naphtha prices by threatening export flows and chokepoints.

To reflect Asia’s structural deficit, we can add an interaction term:

$$N_t = \alpha_0 + \alpha_1 Brent_t + \alpha_2 RefUtil_t + \alpha_3 G_t + \alpha_4 G_t \cdot AsiaDeficit_t + \varepsilon_t^N$$

where ($AsiaDeficit_t$) measures Asia’s net naphtha import requirement. When Asia’s deficit is high, the same level of conflict produces a larger price response.

2. Naphtha → PX, PTA, MEG (feedstock pass-through)

Naphtha then feeds into the aromatics and olefins pathways:

$$P_t^{PX} = \beta_0^{PX} + \beta_1^{PX} N_t + \beta_2^{PX} G_t + u_t^{PX}$$

$$P_t^{PTA} = \beta_0^{PTA} + \beta_1^{PTA} P_t^{PX} + \beta_2^{PTA} N_t + u_t^{PTA}$$

$$P_t^{MEG} = \beta_0^{MEG} + \beta_1^{MEG} N_t + \beta_2^{MEG} NGLshare_t + u_t^{MEG}$$

- ($\beta_1^{PX} > 0$): PX tracks naphtha closely, consistent with the empirical linkage between naphtha, PX and PTA.
- ($\beta_1^{PTA} > 0$): PTA follows PX but with dampened response due to overcapacity.
- ($\beta_2^{MEG} < 0$): higher NGL-based ethylene share weakens MEG's dependence on naphtha.

This encodes the bifurcated chain described earlier:

“Polyester is therefore not a single chain but a bifurcated system, with naphtha feeding both halves simultaneously.”

3. PX, PTA, MEG → PET and margins

PET resin prices reflect the combined influence of PTA and MEG, plus demand:

$$P_t^{PET} = \gamma_0 + \gamma_1 P_t^{PTA} + \gamma_2 P_t^{MEG} + \gamma_3 Demand_t + \epsilon_t^{PET}$$

Polyester margins over naphtha can be approximated as:

$$M_t = P_t^{PET} - c_1 P_t^{PTA} - c_2 P_t^{MEG} - c_3 N_t$$

where (c_1, c_2, c_3) are cost-share parameters. Empirically, these margins have trended downward:

Margins over naphtha for PX, PTA, MEG and PET have trended downward for years, leaving producers financially weakened and more vulnerable to shocks.

4. Dynamic spillover: conflict to polyester

To capture the full transmission of shocks, we can stack the variables into a vector:

$$X_t = (G_t, Brent_t, N_t, P_t^{PX}, P_t^{PTA}, P_t^{MEG}, P_t^{PET})$$

and estimate a vector autoregression (VAR):

$$X_t = AX_{t-1} + e_t$$

Using forecast error variance decomposition, we can quantify how much of the variability in (P_t^{PET}) and (M_t) is explained by shocks to (G_t) and (N_t). A rising share over time would empirically confirm the essay's argument that polyester has become structurally fragile to geopolitical conflict in naphtha.

5. Conflict regimes

Finally, to reflect episodic crises—such as Russia–Ukraine or Hormuz scares—we can allow the coefficients to switch between “calm” and “conflict” regimes:

- Regime variable $S_t \in (\text{calm, conflict})$ driven by (G_t) .
- In conflict regimes, $(\alpha_3, \beta_1^{PX}, \beta_1^{PTA})$ rise (stronger pass-through), while γ_3 , falls (weak demand, limited cost passthrough).

This regime-switching structure formalises the conclusion of the investigation: polyester is now a fibre whose economics are tightly and precariously coupled to geopolitical conflict in a single upstream feedstock—naphtha.

Illustrative numerical example

Any disruption—sanctions tightening, shipping insurance restrictions, port access issues—can rapidly reprice naphtha and, by extension, polyester feedstocks.

1. Set up a very simple version of the model

Take quarterly data and define:

- **Geopolitical conflict index (G_t):**
 - Calm quarter: ($G_t = 0$)
 - High-tension quarter (like a major escalation in the Middle East or tighter sanctions on Russia): ($G_t = 1$)
- **Naphtha price equation (Asia benchmark, USD/tonne)**

$$N_t = 400 + 50 G_t,$$

- **PX price (USD/tonne)**

$$P_t^{PX} = 200 + 0.8N_t,$$

- **PTA price (USD/tonne)**

$$P_t^{PTA} = 100 + 0.9P_t^{PX}$$

- **MEG price (USD/tonne)**

$$P_t^{MEG} = 150 + 0.4 N_t,$$

- **PET price (USD/tonne)**

$$P_t^{PET} = 50 + 0.5P_t^{PTA} + 0.3 P_t^{MEG}$$

- **Polyester margin over naphtha (very simplified)**

$$M_t = P_t^{PET} - 0.5P_t^{PTA} - 0.3P_t^{MEG} - 0.2N_t$$

This is just a numeric toy version of your narrative that:

Polyester is therefore not a single chain but a bifurcated system, with naphtha feeding both halves simultaneously.

2. Calm quarter: ($G_t = 0$)

1. **Naphtha:** $N_t = 400 + 50 \cdot 0 = 400$
2. **PX:** $P_t^{PX} = 200 + 0.8 \cdot 400 = 200 + 320 = 520$
3. **PTA:** $P_t^{PTA} = 100 + 0.9 \cdot 520 = 100 + 468 = 568$
4. **MEG:** $P_t^{MEG} = 150 + 0.4 \cdot 400 = 150 + 160 = 310$
5. **PET:** $P_t^{PET} = 50 + 0.5 \cdot 568 + 0.3 \cdot 310 = 50 + 284 + 93 = 427$
6. **Margin:** $M_t = 427 - 0.5 \cdot 568 - 0.3 \cdot 310 - 0.2 \cdot 400 = 427 - 284 - 93 - 80 = -30$

So, in a calm quarter, this toy chain already has a slightly negative margin (consistent with your “margin compression” story).

3. Conflict quarter: ($G_t = 1$)

Now imagine a “today-style” escalation—tanker attacks, sanctions tightening, or Hormuz risk—so (G_t) jumps from 0 to 1.

1. **Naphtha:** $N_t = 400 + 50 \cdot 1 = 450$
2. **PX:** $P_t^{PX} = 200 + 0.8 \cdot 450 = 200 + 360 = 560$
3. **PTA:** $P_t^{PTA} = 100 + 0.9 \cdot 560 = 100 + 504 = 604$
4. **MEG:** $P_t^{MEG} = 150 + 0.4 \cdot 450 = 150 + 180 = 330$
5. **PET:** $P_t^{PET} = 50 + 0.5 \cdot 604 + 0.3 \cdot 330 = 50 + 302 + 99 = 451$
6. **Margin:** $M_t = 451 - 0.5 \cdot 604 - 0.3 \cdot 330 - 0.2 \cdot 450 = 451 - 302 - 99 - 90 = -40$

4. What this shows

- **Naphtha** rises from **400** → **450** (+12.5%) when conflict jumps from 0 to 1.
- **PET** rises from **427** → **451** (+5.6%), so only part of the feedstock shock is passed through.
- **Margin** falls from **-30** → **-40**, meaning the conflict shock deepens an already weak profitability.

In a simple numerical version of the model, a one-unit increase in the geopolitical conflict index raises naphtha prices by 12.5% but polyester margins fall by a further 10 units, as only part of the feedstock shock can be passed downstream. The conflict shock thus amplifies an already fragile economic structure, pushing a negative-margin chain deeper into loss.

The numerical example shows that in a conflict quarter, naphtha prices jump faster than PET prices, so the shock is absorbed as margin compression rather than fully passed downstream—exactly the pattern seen in a decade of empirical spread data.

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