Commentary and Critique **Research Commentary**
Vol. 8 (2025) · ISSN 3006-6220 journal.pe.ac/Commentary-and-Critique

Red Sea Shipping Disruption and Import Unit Values: Evidence from Four Monthly China–Europe Series

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Published 20 December, 2025.

DOI: https://doi.org/10.62432/APPE.CC.2025.8.31

Article webpage: https://journal.pe.ac/Commentary-and-Critique/paper/view/569780

Abstract

During the Red Sea disruption window, recorded import unit values moved differently across four China–Europe commodity–importer pairs. This study uses 144 all-transport-mode customs aggregates covering the 36 months of 2022–2024. Same-month comparisons with 2023 show that 2024 unit values fell 12.4% for German vehicles and 7.2% for French furniture, compared with a 1.9% fall for Italian knit apparel and a 3.1% rise for British computers. Newey–West sensitivity intervals span both signs for the latter two pairs. Trend-adjusted timing estimates describe a different dimension of the record: French furniture has positive point estimates under every March–July specification, although only April's quadratic-trend interval lies above zero, and all 35 usable French weights are provider-estimated. Germany's July estimate changes from −2.9% with a linear trend to +13.9% with a quadratic trend. The clearest annual outcome is therefore lower recorded unit values for German vehicles and French furniture, alongside much smaller changes for Italian apparel and British computers. Commodity-level divergence, together with substantial trend sensitivity, characterises these customs series during the disruption.

Keywords: Red Sea; shipping costs; import unit values; UN Comtrade; pass-through; monthly panel; China–Europe

1. Introduction

1.1. Disruption and research question

Attacks on commercial shipping in the Red Sea in late 2023 led major carriers to divert Asia–Europe services around the Cape of Good Hope. The Suez Canal remained open, but traffic fell sharply. By February 2024, UNCTAD reported that weekly container-ship transits through the canal were 67% lower than a year earlier and that average Shanghai spot rates to Europe had risen 256% since early December (United Nations Conference on Trade and Development, 2024b). The rerouting lengthened voyages, increased vessel demand and raised fuel, insurance and operating costs (United Nations Conference on Trade and Development, 2024a).

The customs-price implication is less direct. Freight is only one component of the cost, insurance and freight (CIF) value. Exporters, carriers and importers may adjust margins; contracts can delay rate changes; inventories delay the arrival of newly priced goods; and product composition changes the value-to-weight ratio. A large spot-rate shock therefore need not produce an immediate or equal movement in an HS4 unit value.

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This study asks how UN Comtrade monthly unit values for four China–Europe commodity–importer pairs moved during the Red Sea disruption window between January 2022 and December 2024. The records aggregate all transport modes and contain no route, port, carrier, container-use, or Suez-transit field. The disruption is therefore the motivating macro event rather than an observed treatment. The completed 144-observation panel compares 2024 with the same months of 2023 and tests sensitivity to assumed timing and trend form. Without observed exposure or an untreated comparison, the analysis cannot identify causal pass-through.

2. Pass-through and measurement

Exchange-rate research shows why a cost change need not pass one-for-one into an import price. Exporters may price to market, invoices may be fixed in a buyer's currency, and firms at different points in the distribution chain may adjust margins (Campa & Goldberg, 2005; Goldberg & Knetter, 1997; Krugman, 1987). Transport costs add analogous contracting and timing frictions. Empirical work links shipping-cost shocks to inflation, but the size and lag vary with the product, route, market structure and price measure (Carrière-Swallow et al., 2024; Hummels, 2007).

This paper observes customs unit value: total primary value divided by total net weight within an HS4 category. Unit value is not the price of a fixed item. It changes with models, quality, packaging and the relative quantities of products grouped under the same code (Gaulier & Zignago, 2010; Silver, 2007). The four selected pairs also combine a commodity with one importer, so country and commodity effects cannot be separated. These properties motivate pair-specific estimates, explicit timing sensitivity and restrained interpretation.

3. Data and methods

3.1. Monthly trade panel

The analysis uses the UN Comtrade public preview interface (United Nations Statistics Division, n.d.). We retrieved all 36 months from January 2022 through December 2024 for four China–Europe commodity–importer pairs: motor vehicles imported by Germany (DE, HS 8703), furniture imported by France (FR, HS 9403), knit apparel imported by Italy (IT, HS 6110), and computers imported by the United Kingdom (GB, HS 8471). The research question is how their customs unit values moved during the 2024 disruption window.

Each request specified the month, reporter, China as partner (156), imports, and the HS4 code. Each saved response contains one aggregate row satisfying partner2Code=0, customsCode=C00, and motCode=0. In Comtrade, motCode=0 is the total across transport modes, not a maritime or container filter (United Nations Statistics Division, n.d.). The responses contain no shipment route. The acquisition ledger records the request URL, UTC time, HTTP status, byte length, output path, and SHA-256 hash. The resulting panel contains 144 country–commodity months.

Unit value is the customs primary value divided by net weight, in USD/kg. It is a composition-sensitive border measure rather than the price of a fixed product (Gaulier & Zignago, 2010; Silver, 2007). The French response has 35 Comtrade-estimated weights and one missing weight; therefore all 35 observations used in its summaries and regressions rely on provider-estimated weights. Britain has 34 estimated weights among 36 usable observations, Germany one, and Italy none. We interpolate the missing February 2022 French weight geometrically from January and March only to keep the displayed monthly panel rectangular; all annual summaries and regressions exclude that imputed observation.

DOI: 10.62432/APPE.CC.2025.8.31

3.2. Comparisons and uncertainty

The disruption began in late November 2023, while customs records can reflect earlier contracts, inventories, and later arrivals. We therefore report several exploratory calendar cutoffs rather than designate one treatment boundary. March and April 2024 are moderate-delay conventions after the late-November events; July is a deliberately late-window stress test. The data do not observe actual order or route-specific arrival dates, so these cutoffs are timing conventions rather than identified shipment lags.

First, annual means describe the full monthly record. Second, we compare each month of 2024 with the same month of 2023 and report the geometric mean of the twelve log differences. Conventional t intervals are retained in the analysis output; Table 1 uses a Newey–West sensitivity interval with three lags and a residual-degrees-of-freedom t critical value. This comparison removes fixed calendar-month levels but not year-specific changes unrelated to shipping. Third, for cutoffs in November 2023, March 2024, April 2024, and July 2024, we estimate separately for each pair:

log(unit value) = month trend + calendar-month indicators + post-cutoff indicator + error.

The primary form uses a linear trend; the robustness form adds its square. Intervals use Newey–West standard errors with three lags, covariance small-sample correction, and a residual-degrees-of-freedom t critical value. These 35–36-observation models contain 14 or 15 parameters and are exploratory sensitivity summaries, not causal estimates. Commodity and importer remain perfectly confounded; product composition, exchange rates, tariffs, demand, and reporting changes may affect the same outcome. The analysis covers 16 pair-cutoff combinations and 32 fitted specifications, so an interval above zero is not treated as confirmatory significance.

4. Results

4.1. Annual record and same-month changes

Table 1 shows the complete-year means. German vehicle unit values rose in 2023 and then fell below both prior annual means in 2024. French furniture continued a decline already visible before the attacks. Italian apparel remained close to its prior annual levels, while British computers returned near their 2022 mean after a lower 2023.

Table 1. Monthly unit values by calendar year (USD/kg)

Pair	2022 mean	2023 mean	2024 mean	2024 SD	2024 vs 2023, same-month geometric change (95% HAC sensitivity interval)
Germany—vehicles, HS 8703	16.76	18.30	16.02	0.72	−12.4% [−17.6, −7.0]
France—furniture, HS 9403	3.45†	2.88	2.66	0.17	−7.2% [−13.3, −0.6]
Italy—knit apparel, HS 6110	35.14	34.08	33.25	4.94	−1.9% [−7.9, +4.4]
United Kingdom—computers, HS 8471	205.18	198.71	204.60	12.23	+3.1% [−5.3, +12.4]

† The French 2022 mean excludes February, whose aggregate net weight is missing. Source: UN Comtrade monthly responses; calculations in monthly-panel-v02.csv, same-month-2024-vs-2023-v02.csv, and same-month-hac-sensitivity-v03.csv.

The same-month comparison therefore gives two declines, for German vehicles and French furniture, while the Italian and British HAC sensitivity intervals span both signs. This pattern does not show a common increase across all four pairs. It also does not establish that the freight shock had no effect: exposure

is unobserved, the pairs differ in trend and composition, and the British interval remains compatible with an increase of about 12 percent.

4.2. Timing sensitivity

The trend-and-month-adjusted estimates change with both the post-period convention and the functional form (Table 2). March and April impose moderate delays after the November 2023 event; July is a late-window stress test rather than a measured arrival date.

Table 2. Post-cutoff change in log unit value under linear and quadratic trends

Pair	From March 2024: linear; quadratic (95% t-HAC CI)	From April 2024: linear; quadratic	From July 2024: linear; quadratic
Germany—vehicles	L −13.4% [−23.2, −2.4]; Q −16.2% [−30.8, +1.3]	L −10.6% [−21.1, +1.3]; Q −9.4% [−26.4, +11.6]	L −2.9% [−14.1, +9.6]; Q +13.9% [−6.2, +38.2]
France—furniture	L +10.7% [+0.1, +22.5]; Q +12.3% [−4.6, +32.1]	L +11.9% [+2.2, +22.5]; Q +17.0% [+0.7, +36.0]	L +10.6% [+2.2, +19.7]; Q +13.3% [−4.1, +33.8]
Italy—knit apparel	L +2.3% [−8.5, +14.5]; Q +14.4% [−4.8, +37.5]	L +1.0% [−8.8, +11.9]; Q +11.5% [−2.2, +27.2]	L +0.5% [−10.5, +12.9]; Q +9.0% [−5.9, +26.4]
United Kingdom—computers	L +3.6% [−7.5, +16.0]; Q −2.6% [−16.7, +13.8]	L +5.6% [−3.7, +15.8]; Q +3.0% [−8.3, +15.5]	L +7.0% [−3.3, +18.4]; Q +6.2% [−12.6, +29.1]

Source. separate 35–36-month OLS models; Newey–West HAC intervals with three lags, covariance small-sample correction, and residual-df t critical values. L = linear trend; Q = quadratic trend. Full November, March, April, and July estimates are in trend-form-sensitivity-v03.csv.

The linear specification weakens the German decline as the cutoff moves later, but the quadratic July estimate changes sign to +13.9% and has a wide interval. For that German July fit, the quadratic model also has the lower OLS AIC (−72.60 versus −64.85), so the sign change cannot be dismissed as the result of an obviously poorer fit. Italian point estimates rise from roughly 0–2% under the linear trend to 9–14% under the quadratic trend, with all intervals spanning both signs. British estimates are likewise imprecise. French point estimates remain positive across all March–July forms; among the three quadratic specifications, only the April interval remains above zero. This is one result among multiple exploratory fits.

For furniture, the positive adjusted estimates coexist with a negative same-month change because the series was falling before the disruption window; the models compare observations with different projected trends rather than with the prior-year level. All 35 usable French weights are Comtrade estimates, so this pattern is a feature of the provider-estimated series and cannot be separated from estimation or composition changes. Britain has 34 estimated weights among 36 usable months, leaving only two unflagged observations and no useful unestimated-weight sensitivity. The German and Italian results show that trend form is at least as consequential as the assumed timing.

5. Interpretation

The completed all-mode panel changes the earlier sparse-month account in two ways. First, no single direction characterises all four pairs in 2024. Second, the adjusted furniture point estimates are positive, but their intervals and meaning depend on trend form and provider-estimated weights. Neither finding identifies route exposure or freight-cost pass-through.

The unit value contains the customs value of a changing HS4 basket. A rise can reflect higher prices, a shift toward higher-value products, or altered weight reporting; a fall can reflect the reverse. The four commodities also differ sharply in value-to-weight ratio and contracting practices. Within HS 8703, the EU imposed provisional countervailing duties on new battery-electric passenger vehicles under ex 8703 80 10 in July 2024; this subset-specific policy is a contemporaneous confounder, not a treatment of the

entire vehicle aggregate (European Commission, 2024). Furniture relies entirely on estimated weights in the analytic sample. Apparel is seasonal, and computers combine heterogeneous high-value products. These differences make a pooled average misleading.

Exporter absorption, importer margins, freight contracts, inventory, and product substitution remain plausible channels discussed in the literature (Campa & Goldberg, 2005; Carrière-Swallow et al., 2024; Goldberg & Knetter, 1997; Krugman, 1987). This study does not observe any of them. The estimates therefore answer a narrower question: what changed in the recorded unit values, under several timing conventions? They do not determine why it changed or how much of a freight shock passed through.

6. Limitations

The design has no untreated origin, destination, or commodity and does not observe whether any shipment used the Red Sea. Calendar-month indicators address recurring seasonality, while linear and quadratic trends impose different extrapolations; neither supplies a credible untreated counterfactual. With 35–36 observations and 14–15 parameters per fit, the HAC intervals are uncertain and model-dependent. Testing four heterogeneous pairs and four cutoffs also raises multiplicity concerns; the intervals are descriptive rather than confirmatory.

Comtrade's preview records are not marked as directly reported aggregate cells (isReported=false, isAggregate=true) for all 144 pair-month observations. These flags do not identify which records were mirror-derived rather than otherwise aggregated, adjusted, or estimated. All 35 usable French weights and 34 of 36 British weights are flagged as estimated. The single manuscript interpolation is disclosed and excluded from inference, but official estimation embedded in Comtrade cannot be reconstructed. The responses were retrieved on September 26, 2026; this is a later database-vintage reconstruction, and without a retained pre-cutoff snapshot the study cannot establish that these exact values were available by November 20, 2025. Finally, CIF unit value does not isolate freight from the good's free-on-board value, insurance, tariffs, or composition.

7. Conclusion

The 2024 customs record shows a differentiated pattern across the four China–Europe pairs. Relative to the same months of 2023, German vehicle unit values fell 12.4% and French furniture values fell 7.2%. Italian apparel and British computers changed much less, by −1.9% and +3.1%, respectively, with sensitivity intervals spanning both signs. The largest declines thus occurred in the vehicle and furniture series.

Timing models add a qualification to this annual comparison. German estimates change sign in the July quadratic specification; Italian quadratic point estimates exceed their linear counterparts; and British intervals span both signs. French point estimates remain positive under the later windows, although only the April quadratic interval lies above zero and all usable French weights are provider-estimated. Annual declines and positive adjusted timing coefficients describe different comparisons within the same series.

Taken together, the complete monthly record establishes commodity-specific movements during the disruption window: substantial recorded declines in German vehicles and French furniture, smaller annual changes in Italian apparel and British computers, and sensitivity of adjusted timing estimates to the trend specification. These findings concern all-mode bilateral customs unit values and retain the coverage and interpretation defined in the methods.

8. Declarations

Data. All 144 monthly responses, the acquisition ledger, the filtered panel, and the analysis outputs are retained in this revision. The sole manuscript-side weight interpolation is identified in the panel and excluded from annual summaries and regressions.

Author contributions. Timur Bektemirov is responsible for the monthly trade measurement and the paper's central argument. Nargiza Qodirova is responsible for sample-coverage assessment, interpretation of Comtrade's estimated-weight flags, uncertainty reporting, and robustness interpretation.

Statements

Data availability. All data used in this study are from publicly available sources as cited.

AI use. Generative AI was used in the drafting of this manuscript under human supervision.

Funding. This work received institutional support from the Academy of Public Policy and Economics (APPE).

Competing interests. The authors are affiliated with APPE, which operates this journal. No external competing interests are declared.

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