

The impact of fluctuations in international fuel prices on the structure of China's foreign trade

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Abstract:

This study aims to highlight the impact of global fuel price volatility on the structure of China's foreign trade. Given that the Chinese economy contributes more than 30% to global economic growth, any slowdown in China's economic growth directly and negatively affects the performance of the global economy. The size of China's economy and its energy-intensive industrial model have contributed to high fuel demand, making China the world's largest energy consumer and a major driver of global energy demand. This study uses standard time-series analysis to examine the impact of fuel price volatility on the Chinese economy, including stationarity tests, the Johansen cointegration method, and the Granger causality test. The results indicate a cointegration relationship among the variables, and the Granger causality test reveals a unidirectional causal relationship running from global fuel price volatility to fluctuations in China's trade balance.

Keywords: The Chinese economy; fuel prices; oil; energy; China's foreign trade.

JEL Classification Codes : F14 ; Q41 ; Q43.

1. INTRODUCTION

China currently consumes more than 15 million barrels of crude oil per day, while its net daily production does not exceed about 4 million barrels, this structural shortfall means that over two-thirds of its oil demand must be met through imports, sharply increasing the economy's vulnerability to external supply and price shocks. In such a context, any significant fluctuation in international oil prices poses a direct threat to China's economic security and inevitably feeds into its broader strategic orientations. Accordingly Beijing has long sought to build and maintain a substantial strategic petroleum reserve as an instrument of protection against geopolitical disruptions and trade-related energy conflicts. It is therefore not unusual for China to purchase very large volumes of crude even during periods of domestic economic slowdown, seizing episodes of low prices to expand and fill its storage facilities to capacity.

Given this configuration, systematic analysis of fuel-price volatility in China has become indispensable for economic and strategic policymakers. Robust forecasts of the direction and magnitude of fluctuations in hydrocarbon prices form the foundation for early, precautionary hedging policies capable of sustaining long-run growth, ensuring the continuity of vital energy supplies, and absorbing external shocks. The impact of these price movements is no longer confined to the energy sector alone, they now transmit waves of disturbance across virtually all segments of the Chinese and global economy—from the cost of the most basic consumer goods, such as a loaf of bread, to the level and composition of countries' foreign-exchange reserves and the stability of their overall economic security.

1.2 Research problem:

Building on the preceding analysis, this study seeks to address the following primary research question:

What is the impact of volatility in international hydrocarbon prices on the structure of China's foreign trade over the period (1960-2025)?

1.3 Research hypothesis:

To address the research problem, the study advances the following hypothesis: There exists at least one unidirectional causal relationship between international fuel price volatility and the structure of China's foreign trade.

1.4 Significance and objectives of the study:

The significance of this study lies primarily in its focus on the Chinese economy, currently the second largest in the world in terms of scale, Using China as a reference case, it examines how major economic powers reconfigure their trade, commodity and geographical strategies when subjected to sustained energy shocks.

More specifically, the study aims to identify the impact of international hydrocarbon price fluctuations on the structure of China's foreign trade over the period 1960-2025, This is undertaken by tracking the historical evolution of both indicators and then testing for the existence of a long-run equilibrium relationship between them, as well as identifying, where present, the nature and direction of causal linkages.

1.5 Study data:

The empirical analysis is based on annual observations for the period 1960-2025, covering China's trade balance position and Brent crude oil prices.

1.6. Research methodology:

To generate results that are consistent with the study's stated objectives, the analysis relies on a combined descriptive-analytical and econometric strategy, the descriptive and analytical component is used to trace, characterise, and interpret the evolution of the key variables over time, while the econometric component is employed to test for short-run and long-run equilibrium relationships among these variables and to examine the existence and direction of causal linkages between them.

1.7 Literature Review

- Ben Awali Khalidiya, and Hakimi Bouhafa (2021), examined the impact of oil price fluctuations on the management of oil revenues in Algeria over the period 2000-2019, using an autoregressive distributed lag (ARDL) model, the authors employed an econometric modelling framework to quantify how changes and trends in international oil prices affect the level and management of Algeria's oil revenues, their results indicate that oil prices exert a direct effect on the value of oil revenues.
- Jadi Sasia and Ativa Halima (2020), analysed the determinants repercussions and

broader effects of oil price volatility, using a case study of selected industrial and financial economies over the period 2004-2014, the authors concluded that global oil markets are shaped by a constellation of factors: fundamental supply- and demand-side conditions, political developments in key producing and consuming regions, and the institutional and regulatory arrangements governing market operations.

1.8 Definition of the study variables

This study focuses on two core variables:

- Brent crude oil price (p): Denoted by p, this variable captures the international benchmark price of Brent crude, a relatively light grade of oil that can be refined efficiently into gasoline and diesel-products that constitute the backbone of China's energy demand, Brent is particularly suited to Chinese refineries, which operate under increasingly stringent environmental regulations, when the Brent price rises above roughly 90 USD per barrel, it tends to impose substantial pressure on production costs in China, Conversely, a sustained decline below about 70 USD per barrel may be interpreted as a signal of weakening global economic activity, with adverse repercussions for Chinese exports through reduced external demand.

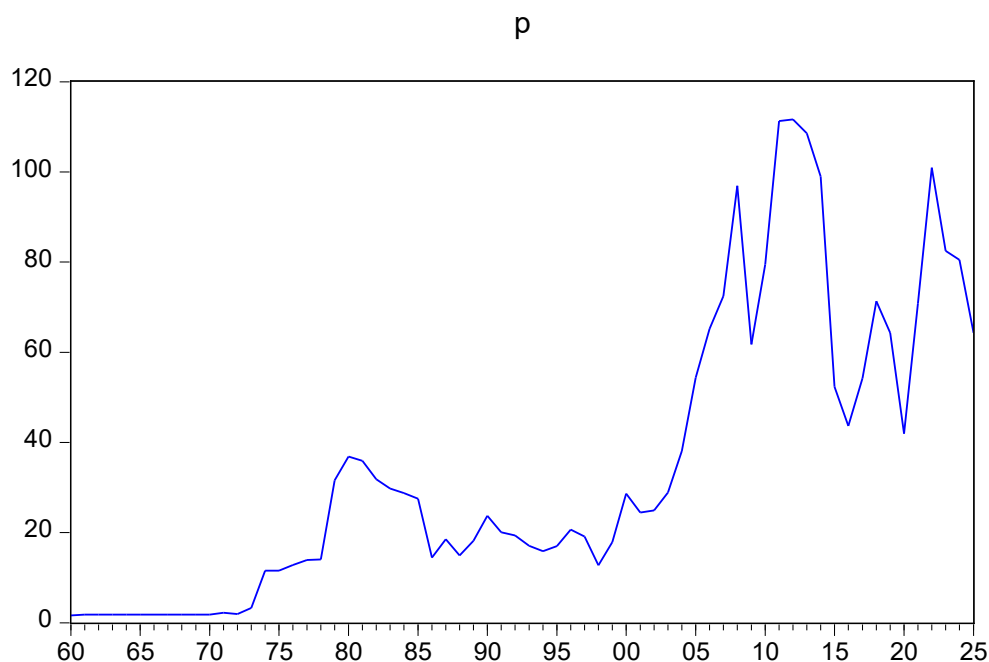
- Chinese trade balance (x): Denoted by x, the Chinese trade balance has attracted exceptional attention in academic and policy circles worldwide, In the case of China, it is not treated as a simple arithmetic difference between exports and imports; rather, it functions as a structural indicator of the country's positioning, bargaining power and integration within the global economic system.

2. Theoretical framework of the study

2.1 Evolution of Brent crude prices (1960-2025):

Since the early 1960s, global fuel prices-and crude oil prices in particular-have undergone pronounced volatility and passed through distinct phases, these shifts have been driven by a combination of economic, political and geopolitical factors, the main stages of this evolution are illustrated in the following figure. (World Bank. 2023)

Fig.1 Evolution of Brent crude oil prices, 1960-2025



Source: Author's elaboration based on World Bank data reports. Available at: www.worldbank.org.

The period from 1960 to 1970 is generally characterised as one of relative stability in oil prices, during which the "Seven Sisters" international oil majors effectively controlled the market and maintained crude prices at relatively low levels, this pattern persisted until the onset of the first oil shock, spanning roughly 1973 to 1985, when prices rose sharply to unprecedented levels, triggering profound structural shifts in the global economy.

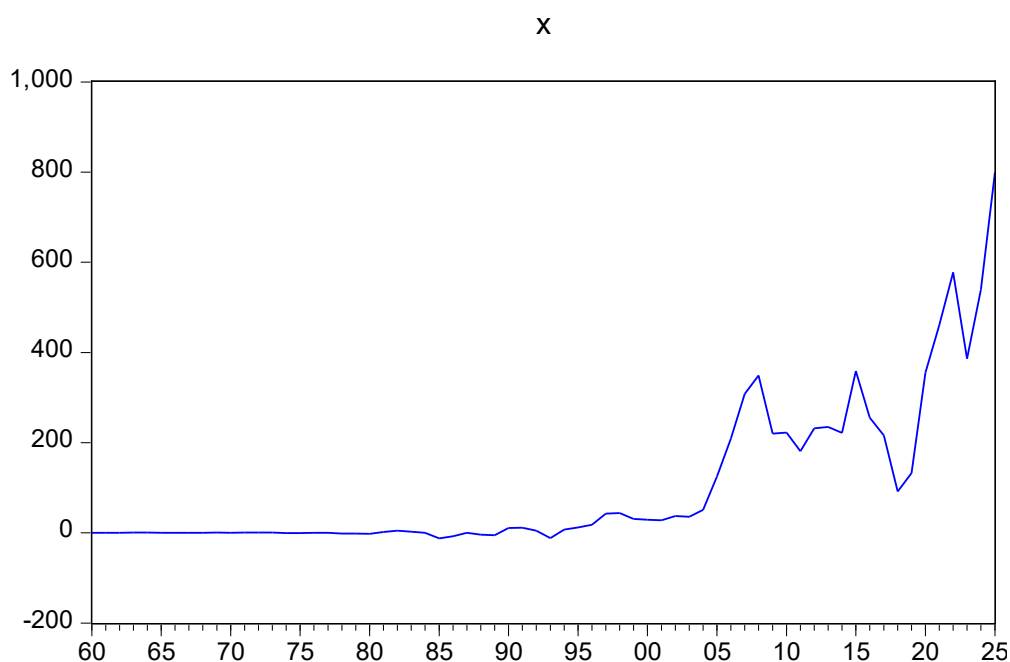
From 1986 to 1999, oil prices experienced a pronounced decline, driven mainly by increased production capacity and a slowdown in global demand, this phase was followed by a sustained upswing between 2000 and 2014, during which hydrocarbon prices climbed in response to rapid growth in emerging economies and heightened geopolitical tensions, reaching a peak around 2008. (Amenec Noel, 2008)

The years 2015 to 2019 were marked by a relative easing of prices (Brinis, S. A., & Dahmani, N. E. H. 2020), largely attributable to the shale oil revolution in the United States and the resulting supply glut, by contrast the period from 2020 to 2025 has been dominated by sharp and recurrent price swings, shaped by the combined effects of the COVID-19 pandemic, the Russia-Ukraine war, escalating US-Iran tensions and US interventions in Venezuela.

2.2 Evolution of China's trade balance (1960-2025)

China's trade balance has undergone a profound shift since 1960, Under the earlier period of economic closure, it was characterised by a fragile and often marginal equilibrium. With the subsequent adoption of the open-door and export-oriented development strategy, this pattern gradually gave way to persistent and expanding trade surpluses, as illustrated in the following figure. (Zouaoui, Z., & Semouk N. 2022)

Fig.2 Evolution of China's trade balance performance, 1960-2025



Source: Author's elaboration based on World Bank data reports. Available at: www.worldbank.org.

China's accession to the World Trade Organization in 2001 constituted a major turning point, propelling the country into the position commonly described as the "world's factory" More recently, during the period 2020-2025, China has recorded redyrd-breaking trade surpluses exceeding one trillion US dollars, driven by a structural shift away from low-cost, labour-intensive goods toward higher value-added exports in advanced technology, electric vehicles and artificial intelligence, despite the persistence of significant global trade tensions over this interval. (IMF Working Papers,2021)

3. Testing the relationship between international fuel prices and China's trade balance

3.1 Model specification

This part of the study examines how volatility in international fuel prices is transmitted to the performance of China's trade balance. An econometric model is

constructed using annual data for the period 1960-2025.

In the baseline specification, the Brent crude price is treated as the independent variable, while the Chinese trade balance is modelled as the dependent variable over the entire sample, the core question is whether, and to what extent, fluctuations in Brent prices affect the trade balance outcome, the notation adopted for the study variables, as used in the subsequent statistical estimations, is summarised in the following table.

Table 1. Study variables and notation

No.	Variable	Symbol
1	Brent crude oil price	p
2	China's trade balance	x

It is evident that China's trade balance is influenced by a wide range of factors beyond this single determinant, however, for the purposes of this study and in line with its core objective, the analysis is deliberately restricted to this specific explanatory variable.

3.2 Estimation procedure

We begin by verifying the stationarity properties of the two-time series under consideration, namely Brent crude prices and China's trade balance. Once their order of integration has been established, the Johansen (1981) cointegration test is applied to assess whether a long-run equilibrium relationship exists between them, Conditional on the cointegration results, Granger causality tests are then employed to investigate the presence and direction of short-run causal linkages between the two variables.

3.3 Testing the stationarity of the time series under study

Stationarity constitutes a basic prerequisite for any meaningful time-series analysis, a series is regarded as stationary when its fluctuations are centred around a constant mean

that does not change over time and its variance remains stable, by contrast a series is classified as non-stationary when it displays a systematic pattern or persistent trend-upward or downward-indicating a clear and evolving dependence on time.

In applied work, the stationarity of economic time series is typically assessed using unit-root tests, most notably the Dickey-Fuller test in its simple and augmented (ADF) forms, as well as the Phillips-Person test, these procedures are designed to determine whether the series contains a unit root and, on that basis, to decide whether it should be treated as stationary or non-stationary. In addition to these formal tests, qualitative diagnostics are employed, including visual inspection of the time-series plots and analysis of the autocorrelation and partial autocorrelation functions.

For a stochastic process to be considered weakly stationary, it must satisfy the following properties:

- **Stationarity:** The invariance of the mean across the temporal domain.

$$E(y_t) = E(y_{t-s}) = \mu_t$$

- **Homoscedasticity:** This assumption necessitates that the variance-representing the dispersion of data points-remains constant and time-independent.

$$E(y_t - \mu)^2 = E(y_{t-s} - \mu)^2 = \sigma_y^2$$

- **Autocovariance:** a key component of the broader concept of stationarity, in time-series analysis, it is defined as the covariance between any two observations of the same variable, expressed as a function of the time lag separating those observations.

$$E[(Y_t - \mu)(Y_{t-s} - \mu)] = E[(Y_{t-j} - \mu)(Y_{t-s-j} - \mu)] = \gamma_s$$

We employ the Augmented Dickey-Fuller (ADF) test to verify the presence of a unit root in the time series of the study variables. The ADF procedure is estimated under three standard specifications:

- A model including both an intercept (constant term) and a deterministic time trend (t).
- A model including an intercept but excluding a deterministic time trend.
- A model without either an intercept or a deterministic time trend.

The statistical evaluation of the aforementioned specifications is governed by the following binary hypothesis structure:

- Null hypothesis: $(H_0): \lambda = 0$
- Alternative hypothesis: $(H_1): \lambda \neq 0$

To mitigate the problem of serial correlation in the error term, we include m lagged difference terms in the ADF specification, the procedure begins by testing the stationarity of each series in levels. If the level series proves non-stationary, we take the first difference and re-test, should stationarity be achieved at this stage, the process

stops; if not, we proceed to the second, then the third difference, and so on, until a common order of integration is established for the series.

In implementing the unit-root tests, we rely on the conventional comparison between the calculated t-statistic and its corresponding critical (tabulated) values, using their absolute magnitudes, this yields the following decision rule:

- Acceptance of the null hypothesis (H_0):
If the absolute value of the calculated t-statistic is smaller than the absolute value of the corresponding critical t-value, we fail to reject the null hypothesis and reject the alternative. In this case, the time series is judged to contain a unit root and is therefore non-stationary.
- Acceptance of the alternative hypothesis (H_1):
If the absolute value of the calculated t-statistic exceeds the absolute value of the critical t-value, we reject the null hypothesis in favor of the alternative. This outcome implies that the series does not contain a unit root and can accordingly be treated as stationary.

3.4 Testing the stationarity of the time series for the study variables using the ADF test at the significance level ($\alpha = 0.05$)

Table 2. Results of the Augmented Dickey-Fuller test in levels at the significance level ($\alpha = 0.05$)

Variable	Specification	Calculated t-Statistic	Critical Value (5%)	Inference
P	Intercept & Trend	1.6320	2.9069	Non-stationary
	Intercept	2.8457	3.4804	Non-stationary
	None	0.6439	1.9459	Non-stationary
X	Intercept & Trend	2.3451	2.9117	Non-stationary
	Intercept	0.6410	3.4878	Non-stationary
	None	2.8801	-1.9464	Stationary

Source: Author's calculations based on EViews 7 outputs.

As shown in the table above, the Augmented Dickey-Fuller test results for the three model specifications, applied to the series in levels at the significance level ($\alpha = 0.05$),

indicate that the Brent crude price series (p) is non-stationary in all three cases, by contrast, the series for China's trade balance is non-stationary under the first and second specifications, but attains stationarity under the third. This mixed outcome justifies re-estimating the ADF test at the level of first differences for the variables under study.

Table 3. Results of the Augmented Dickey-Fuller test at the first difference, at the significance level ($\alpha = 0.05$)

Variable	Model Specification	tt-Statistic	Critical Value (5%)	Outcome
P	None	1.6439	1.9459	Non-stationary
	Intercept	6.9871	2.9084	Stationary
	Intercept & Trend	7.3725	3.4815	Stationary
X	None	0.0397	1.9465	Non-stationary
	Intercept	0.4916	2.9126	Non-stationary
	Intercept & Trend	3.2107	3.4878	Non-stationary

Source: Author's calculations based on EViews 7 outputs.

The results in the above table show that, at the significance level ($\alpha = 0.05$) and after first differencing, the Brent price series (p) remains non-stationary under the third specification, which excludes both an intercept and a time trend, but becomes stationary under the other two specifications that include a constant, with or without a trend, By contrast, the Chinese trade balance series (x) remains non-stationary across all three models, This outcome necessitates reapplying the unit-root tests at the second-difference level.

Table 4. Results of the Augmented Dickey-Fuller test at the second difference, at the significance level ($\alpha = 0.05$)

Variable	Model Specification	tt-Statistic	Critical Value (5%)	Outcome
P	None	7.0130	1.9462	Stationary
	Intercept	6.8974	2.9100	Stationary
	Intercept & Trend	6.9517	3.4852	Stationary
X	None	7.4223	1.9462	Stationary
	Intercept	7.3775	2.9100	Stationary
	Intercept & Trend	7.3430	3.4852	Stationary

Source: Author's calculations based on EViews 7 outputs.

The results reported in the above table indicate that, at the significance level ($\alpha = 0.05$) and after second differencing, the Brent crude price series (p) is stationary under all three

model specifications, the same conclusion applies to the Chinese trade balance series (x), which also exhibits stationarity in each of the three cases.

4. Johansen cointegration test:

The concept of cointegration concerns the existence of a long-run equilibrium relationship among time series that are individually non-stationary in levels, Engel and Granger (1987) showed that when two or more series are integrated of the same order- i.e. each becomes stationary only after differencing a certain number of times-it may nevertheless be possible to construct a stationary linear combination of them, This stationary combination constitutes the cointegrating equation, in which the idiosyncratic short-term fluctuations of each series offset one another, so that the ratio or weighted relationship between the variables remains stable over time. (Engle, R. F., & Granger, C. W. J. 1987).

In practical terms, the presence of cointegration between two non-stationary variables implies that, despite their individual stochastic trends, they are tied together by a stable long-run relationship, this in turn legitimises the estimation of regression equations linking these variables, as the resulting coefficients are statistically meaningful and the problem of spurious regression is avoided. (Granger, C. W. J. 1986)

4.1 Conditions for cointegration:

For cointegration to hold between two-time series, a number of technical conditions must be satisfied, the first concerns the order of integration: both series must be non-stationary in their original form yet become stationary after differencing the same number of times, in other words, they must be integrated of the same order, where that order corresponds to the number of differences required to achieve stationarity.

The second condition relates to the behavior of the residuals from the estimated long-run relationship. The error term generated by the linear regression linking the two variables must itself be stationary and integrated of a lower order than the original series. When this residual series is stationary, the underlying linear combination is regarded as the cointegrating equation. It represents a stable long-run equilibrium relationship between variables that are individually non-stationary in levels.

Within this framework, the Johansen test provides a powerful multivariate statistical tool for examining whether a set of time series, all integrated of the same order, share one or more cointegrating vectors, the procedure is implemented in the context of vector autoregressive (VAR) models and their vector error-correction (VECM) representations.

Table 5. Key advantages of the Johansen test:

A central strength of the Johansen procedure lies in its ability to determine whether the system exhibits a unique cointegrating relationship-the case in which a single long-run equilibrium vector links the dependent variable to the set of explanatory variables, when such uniqueness is absent, the interpretation of any putative equilibrium relationship becomes considerably more ambiguous and analytically suspect.

Given that the unit-root tests indicate all series in the model attain stationarity only after second differencing, the next critical step is to examine the order of integration of the residual series and verify its stationarity.

4.2

Advantage	Explanation
Small-sample suitability	Produces reasonably reliable results even when the time series consists of relatively few observations.
Multiple cointegration vectors	Allows for the presence of more than one cointegrating relationship among the variables.
Identification of cointegration rank	Distinguishes whether there is a single long-run equilibrium relationship or several such relationships.

Stationarity of the residual series:

Table (6) shows that the residual series is non-stationary in levels under all three model specifications.

It is therefore necessary to re-test the residuals after taking the first difference.

Table 6. Test of the stationarity of the residual series at the significance level ($\alpha = 0.05$)

Variable	Model Specification	tt-Statistic	Critical Value (5%)	Outcome
Residuals (u)	None	1.4600	1.9400	Non-stationary

	Intercept	1.4950	2.9000	Non-stationary
	Intercept & Trend	1.0700	3.4800	Non-stationary

Source: Author's calculations based on EViews 7 outputs.

Table (7) shows that the residual series becomes stationary at the first difference across all three specifications, that is, at an order of integration lower than that of the original time series used in the model, this outcome confirms that both necessary conditions for the existence of cointegration are satisfied.

Table 7. Test of the stationarity of the residual series at the first difference, at the significance level ($\alpha = 0.05$)

Variable	Model Specification	tt-Statistic	Critical Value (5%)	Outcome
Residuals (u)	None	6.348	1.940	Stationary
	Intercept	6.332	2.900	Stationary
	Intercept & Trend	6.672	3.480	Stationary

Source: Author's calculations based on EViews 7 outputs.

Once the conditions for applying the Johansen (1988) cointegration test are satisfied, it becomes necessary to determine the optimal lag length between the variables under study.

4.3. Selection of the optimal lag length:

The lag length reflects the time interval between a change in one variable and the manifestation of its effect on another; that is, the period required for a shock to variable to be transmitted to variable y, Equivalently, it denotes the number of time periods needed for the impact of x to become observable in y. In empirical implementation, the optimal lag order is chosen by estimating alternative specifications and selecting the one that yields the lowest value for the standard information criteria: Akaike (AIC), Schwarz (SC), and Hannan-Quinn (HQ).

Table 8. Selection of Optimal Lag Length

Lag	0	1	2	3	4
Log L	-685.865	-592.266	-590.475	-587.746	576.427
LR	NA	178.1388	3.293441	4.842399	*19.35152
FPE	14849086	825153.3	886581.8	9204815	*731941

AIC	22.189	19.298	19.370	19.411	*19.175
SC	22.2578	19.7132	19.8914	19.7926	*19.5048
HQ	22.216	19.599	19.5048	60.09730	*19.3797

Note: Asterisks (*) denote the lag length selected by the respective criterion.

Source: Author's calculations based on EViews 7 outputs.

The table shows that all the information criteria consistently point to an optimal lag length of four periods.

4.4. Cointegration testing:

On this basis, the Johansen cointegration test is implemented, and the results for the study variables are summarised in Table (9).

Table 9. Results of the cointegration test for the study variables at the significance level ($\alpha=0.05$)

Source: Author's calculations based on EViews 7 outputs.

Drawing on Table (9), and in particular the second row corresponding to ($r=1$), the Johansen trace test at this stage evaluates the following hypotheses:

- Null hypothesis (H_0): there is exactly one cointegrating vector,
- Alternative hypothesis (H_1): there is more than one cointegrating vector.

To interpret the results, the calculated trace statistic is compared with the tabulated critical value according to the usual decision rule:

- If the calculated trace statistic exceeds the critical value, we reject (H_0) in favour of (H_1), indicating the presence of more than one cointegrating relation.
- If the calculated trace statistic is lower than the critical value, we fail to reject

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.306303	24.93803	15.49471	0.0014
At most 1	0.042184	2.629074	3.841466	0.1049

(H_0) and reject(H_1), which implies the existence of a single cointegrating vector.

In our case, the trace statistic (2.62) is smaller than the 5% critical value (3.84), i.e.

$$\text{Trace statistic} = 2.62 < 3.84 = \text{Critical value}$$

Accordingly, we retain the null hypothesis (H_0) and conclude that there is one unique cointegrating vector between the variables.

Accordingly, the alternative hypothesis (H_1) which posits the existence of more than one cointegrating vector, is rejected at the 5% significance level ($\alpha=0.05$).

The Maximum Eigenvalue statistic corroborates this conclusion, as shown in the following table:

Table10. Results of the Maximum Eigenvalue cointegration test at the 5% significance

Level				
Hypothesized	Max-Eigen		0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.306303	22.30896	14.26460	0.0022
At most 1	0.042184	2.629074	3.841466	0.1049

Source: Author's calculations based on EViews 7 outputs.

Table (10) reinforces the preceding findings, as it shows that for the case $r=1$ the Maximum Eigenvalue statistic is lower than its 5% critical value (Max-Eigen statistic = 2.62 < 3.84 = critical value).

On this basis, the model leads to acceptance of the null hypothesis (H_0), which posits the existence of a single cointegrating vector among the variables, and to rejection of the alternative hypothesis (H_1), which would imply more than one cointegrating relationship, at the 5% significance level ($\alpha=0.05$).

Taken together, the results of both the Trace and Maximum Eigenvalue tests consistently indicate the presence of exactly one cointegrating vector at ($\alpha=0.05$) between the time series for international fuel prices and the time series describing the evolution of China's trade balance.

Having established the existence of a long-run equilibrium relationship between the two variables under study-international fuel prices P and China's trade balance X , we now turn to examining their short-run interaction through causality testing.

5. Granger causality between fuel prices and China's trade balance:

The Granger causality test, originally formulated by Granger (1969), is a statistical procedure designed to investigate causal linkages among time series by estimating a series of regressions. It allows us to determine whether past values of one variable contain incremental predictive information about another variable, and to identify the appropriate lag structure through which these effects materialise.

In light of the preceding analysis, we proceed to test the following two hypotheses: The null and alternative hypotheses can be formulated as follows:

- Null hypothesis (H_0): no causal relationship exists.
- Alternative hypothesis (H_1): a causal relationship exists.

The results of the Granger causality tests between the study variables are reported in the following table (11):

Table (11). Granger causality test results between the study variables

Null hypothesis	Obs.	F-statistic	Prob.
X does not Granger-cause P	62	1.26211	0.2965
P does not Granger-cause X	62	3.21791	0.0194

Source: Author's calculations based on EViews 7 outputs.

From Table (11), the following can be observed:

▪ Causal relationship from China's trade balance (x) to fuel prices (p):

The computed Fisher F-statistic is 1.26211, which is lower than the corresponding critical F-value at the 5% significance level with four lags, the associated probability value is 0.2965, exceeding the 0.05 threshold, Consequently, the null hypothesis of no Granger causality from x to p is retained, and the alternative hypothesis is rejected. Hence, variations in the performance of China's trade balance do not exert a causal influence on fuel prices when four lags are included in the specification.

▪ Causal relationship from fuel prices (p) to China's trade balance (x):

The calculated Fisher F-statistic is 3.21791, which exceeds the corresponding critical value at the 5% significance level with four lags, the associated probability is 0.0194, i.e. below 0.05, On this basis, the null hypothesis of no Granger causality from p to x is rejected in favour of the alternative. Accordingly, changes in international fuel prices Granger-cause changes in the performance of China's trade balance when a four-period lag structure is considered.

6. CONCLUSION:

This study set out to examine the impact of international fuel price volatility on the structure of China's foreign trade over the period 1960-2025, The main empirical findings are as follows:

- The time-series analysis shows that all variables are non-stationary in levels and at first difference, but become stationary after second differencing. Both series are therefore integrated of order two, which provides the necessary conditions for applying cointegration techniques.
- The Johansen cointegration test indicates the existence of a statistically significant long-run equilibrium relationship between international fuel prices and China's trade balance at the 5% significance level.
- The Granger causality results reveal a unidirectional causal relationship running from international fuel prices to China's trade balance, also at the 5% level, while no reverse causality from the trade balance to fuel prices is detected.
- On this basis, the central hypothesis of the study is supported: there is at least one one-way causal link from international fuel prices to China's trade balance at conventional significance levels.
- Crude oil continues to occupy a prominent position in shaping the global economic and geopolitical landscape, despite mounting regulatory pressures oriented toward environmental sustainability.
- Recurrent fuel-price volatility has compelled Chinese economic policymakers to reconfigure the country's industrial structure, with a discernible shift toward more technologically sophisticated and higher-quality manufacturing, alongside a growing strategic focus on artificial intelligence, semiconductor technologies and information-intensive industries.

Recommendations:

On the basis of the empirical findings, the study advances the following recommendations:

- Accelerate the green transition and decarbonisation agenda, China should move more rapidly toward a low-carbon growth model by expanding the deployment of renewable energy, upgrading grid and storage infrastructure, and improving the efficiency and reliability of clean-energy systems.
- Manage trade and geopolitical relations more strategically, External economic relations need to be handled with greater institutional discipline and transparency, including stricter adherence to established trade rules and clearer communication of policy intentions, in order to limit exposure to sanctions and other politically driven disruptions.
- Rebalance towards demand-side reform and technology-intensive growth, Having largely optimised the supply side, China should deepen reforms on the demand side-strengthening household consumption and private investment-while simultaneously fostering innovation, raising productivity, and further reorienting its industrial base toward advanced, high-technology sectors.

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