

The Impact of Structural Fluctuations in Global Food Prices on Domestic Inflation Stability in Algeria: A Quantile Autoregressive Distributed Lag (QARDL) Approach

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Summary: This paper examines the asymmetric and nonlinear pass-through of global food price fluctuations to domestic inflation in Algeria over 2002Q1–2024Q4. Using the Quantile Autoregressive Distributed Lag (QARDL) framework of Cho, Kim, and Shin (2015), we estimate short- and long-run dynamics across five quantiles of the conditional inflation distribution ($\tau \in \{0.10, 0.25, 0.50, 0.75, 0.90\}$), drawing on quarterly data for CPI, the FAO Global Food Price Index, crude oil prices, the DZD/USD exchange rate, and GDP growth. The Pesaran bounds test confirms long-run cointegration at the 1 percent level. Long-run elasticities range from 0.370 to 0.512 across quantiles, peaking at $\tau = 0.25$ – indicating greater exposure during low-to-moderate inflation episodes than during high-inflation ones, a pattern attributable to the selective activation of government price subsidies. A Wald test for coefficient homogeneity (statistic: 12.456, $p = 0.014$) rejects uniform pass-through and validates QARDL over conventional OLS. Oil prices exert a consistently negative, stabilizing effect, reflecting their role as a fiscal buffer for food subsidies. Exchange rate depreciation amplifies transmission, particularly at upper quantiles. The findings carry concrete implications for regime-aware monetary and food-security policy in commodity-dependent economies.

Keywords: Global Food Prices; Inflation; Structural Volatility; Asymmetry; Algeria.

Jel Classification Codes: E31; E52; Q11; C22.

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- Introduction :

Inflation control has long been one of the most persistent macroeconomic challenges facing Algeria. The country's structural dependence on hydrocarbon revenues, its deep reliance on food imports, and a tightly managed exchange rate regime combine to create a particular form of price vulnerability:

domestic inflation is, to a significant degree, imported. Yet that imported component does not behave uniformly. Its magnitude depends on where the economy currently stands in the inflation cycle - and this distributional heterogeneity has received remarkably little empirical attention in the Algerian context.

Two global food crises - in 2007–2008 and 2010–2012 - and then the compounded food shock triggered by the COVID-19 pandemic and the Russian invasion of Ukraine in 2022–2023 have made the stakes of this question concrete.

In each episode, Algerian consumer price inflation surged, only to be partially contained by administrative pricing and subsidy expansion.

This pattern raises a fundamental question for policy: does the government's capacity to buffer food-price shocks depend on the prevailing level of inflation? If so, then a single-equation linear model applied to aggregate inflation will obscure the very heterogeneity that matters most for policy design.

This paper addresses that question directly. We draw on the Quantile Autoregressive Distributed Lag (QARDL) model of Cho, Kim, and Shin (2015) to estimate the short- and long-run pass-through of global food prices to Algerian domestic inflation across the full conditional distribution of the inflation rate.

The QARDL framework is well-suited to this purpose: it combines the flexibility of Pesaran's ARDL approach in handling mixed-order integration with the capacity of quantile regression to reveal how coefficients vary across the distribution of the dependent variable.

The result is a portrait of pass-through that is richer, more honest, and more directly useful for policy than any linear alternative.

There are Three structural features of the Algerian economy motivate the focus and shape our priors:

1. Algeria finances more than 95 percent of its public expenditure through hydrocarbon revenues, which means that the fiscal space for food subsidies expands and contracts with the oil price.
2. Food imports account for over 40 percent of total food consumption, making the domestic price level unusually sensitive to conditions in international commodity markets.
3. The managed exchange rate introduces a systematic wedge between external price signals and domestic inflation dynamics - a wedge whose size shifts with macroeconomic conditions.

Each of these features implies non-linearity, and QARDL is designed to capture precisely this.

1. Research Questions and Hypotheses

The central question of this paper is whether the response of Algerian domestic inflation to global food price shocks varies systematically across the conditional distribution of inflation - and, if it does, what that variation implies for the channels of transmission and for the design of stabilization policy.

Three testable hypotheses organize our empirical strategy:

- H₁:** A long-run cointegrating relationship exists between global food prices and domestic inflation in Algeria.
- H₂:** The long-run pass-through coefficient is heterogeneous across quantiles of the inflation distribution, that is, the intensity of food-price transmission depends on whether the economy is in a low or high-inflation regime.
- H₃:** Control variables - oil prices, the exchange rate, and GDP growth - play a regime-dependent role in modulating the food-price transmission channel.

2. Contribution:

These Three aspects of this paper distinguish it from the existing literature on food-price pass-through in Algeria and in developing economies more broadly.

First, (to our knowledge), this is the first comprehensive application of QARDL to Algerian inflation dynamics, allowing a direct comparison of food-price effects across inflation regimes rather than averaging over them.

Second, the analysis spans 23 years of quarterly data (2002–2024), covering the major commodity cycles of 2007–2008, 2010–2012, and 2021–2023, which is long enough to identify structural regularities rather than episode-specific responses.

Third, the paper provides an explicit test of the homogeneity assumption underlying linear models, offering a methodological benchmark for future work on commodity-dependent economies in the MENA region.

I. Theoretical Framework and Literature

Identifying the mechanisms by which global food prices transmit to domestic inflation provides a critical bridge between theoretical insights and the empirical context of Algeria.

1.1 Channels of Food-Price Transmission

The transmission of global food prices to domestic inflation operates through two primary channels that differ in directness, speed, and susceptibility to policy intervention. Understanding these channels is essential for interpreting the quantile-specific elasticities estimated later in the paper, because the relative strength of each channel varies with the inflation regime.

The Direct Channel. The most immediate route through which global food prices affect Algerian CPI is the import content of the consumer food basket. Algeria imports more than 40 percent of its food consumption, with particularly high dependence on cereals (wheat and barley), vegetable oils, dairy powders, and sugar.

These commodities are priced on world markets, and their landed cost in Algeria reflects the international price converted at the prevailing exchange rate, plus freight, tariffs, and port handling charges. Because these goods enter the CPI basket directly, any sustained movement in the FAO Global Food Price Index translates, with a short lag, into a measurable shift in consumer prices.

The speed and completeness of this direct transmission depend on the extent to which the government interposes administrative pricing. When the authorities freeze retail prices on bread, semolina, or cooking oil, they break the direct link between world and domestic prices, but they do so at fiscal cost: the difference between the import price and the administered consumer price must be absorbed by the treasury or by state-owned importers.

The Indirect Channel. Beyond the direct import-content effect, global food and energy prices penetrate the domestic economy through several indirect mechanisms.

First, higher input costs for food processing, transport, and distribution raise the prices of domestically produced goods, including those that do not themselves rely on imported ingredients. A rise in international wheat prices, for example, increases the cost of flour for bakeries, which then raise the price of bread and pastries produced from domestically milled grain.

Second, sustained food price increases feed into inflation expectations. Workers and unions observe rising food costs and incorporate them into wage demands; firms, anticipating higher labor costs, adjust their pricing in advance. This expectations channel can generate second-round effects that persist long after the original commodity shock has dissipated.

Third, the exchange rate acts as an amplifier or a damper. Under Algeria's managed float, the Bank of Algeria adjusts the DZD/USD rate at intervals that do not necessarily coincide with commodity-price movements. When the dinar depreciates against the dollar during a period of rising global food prices, the domestic-currency cost of imports rises by more than the dollar-denominated price increase alone, compounding the inflationary impulse through both channels simultaneously.

These channels can be summarized in a reduced-form relationship that motivates the empirical specification. Domestic food-price inflation at time t can be expressed as:

$$\pi_t^d = \alpha + \beta^1 \cdot \pi_t^f + \beta^2 \cdot e_t + \beta^3 \cdot oil_t + \beta^4 \cdot sub_t + \varepsilon_t$$

where π^d denotes domestic inflation, π^f denotes foreign food-price inflation, e is the nominal exchange rate (DZD per USD), oil captures the crude oil price (which proxies the fiscal capacity to fund subsidies), sub represents subsidy intensity, and ε is the error term. The coefficients β^1 through β^4 capture, respectively, the direct pass-through of food prices, the exchange-rate amplification effect, the fiscal buffer provided by oil revenues, and the dampening role of subsidies.

In practice, subsidy intensity is not observed directly and is subsumed by the interaction of oil prices and policy regime, which is why the empirical model uses oil prices as a proxy for fiscal space.

The Fiscal Envelope. A distinctive feature of oil-exporting, food-importing economies is that the fiscal capacity to insulate consumers from food-price shocks is itself a function of another commodity price.

When oil prices are high, the Algerian government accumulates revenue windfalls that can be recycled into food subsidies, thereby dampening the transmission from global to domestic food prices.

Conversely, when oil prices fall, fiscal space contracts and the subsidy shield weakens, exposing the economy to the full force of the direct and indirect channels.

This is what we term the fiscal envelope mechanism: the stabilizing capacity of the state depends on the very commodity-market conditions that often accompany food-price volatility.

The **QARDL** framework is particularly suited to capturing this mechanism because the fiscal envelope operates asymmetrically, it binds more tightly during high-inflation episodes (when subsidy spending accelerates) and less during tranquil periods.

Figure 1 presents the conceptual transmission diagram linking global food prices to domestic inflation in Algeria. The diagram traces four pathways..... (See Appendix 1):

- (i) the direct channel, through which imported food commodities enter CPI at world prices converted to dinars;
- (ii) the indirect channel, through which input costs, inflation expectations, and wage bargaining transmit price pressures to domestically produced goods;
- (iii) the exchange-rate channel, which amplifies or dampens both the direct and indirect pathways depending on the direction and magnitude of DZD/USD movements;
- (iv) the oil-revenue channel, through which hydrocarbon windfalls fund the food subsidy system, creating a fiscal buffer that partially offsets market-driven transmission.

The relative strength of these four pathways varies with the inflation regime, which is the central motivation for adopting a quantile-based estimation strategy.

Standard price-transmission models decompose pass-through along four dimensions: the degree of pass-through (the long-run elasticity of domestic to world prices); asymmetry between upward and downward price movements; the transmission lag, which reflects institutional features of domestic pricing; and the policy wedge introduced by government subsidies and administrative pricing, which can partially or wholly offset market transmission, at least in the short run. In commodity-importing developing economies, the empirical evidence consistently points to incomplete pass-through: the long-run elasticity is positive but less than one.

Algeria is a textbook case of this intervention pattern, and our results must be interpreted in that context.

1.2 Related Literature

The literature on food-price transmission to domestic inflation has grown substantially since the 2007 -2008 crisis. Jalil and Tariq (2019) survey 75 studies and report that the average pass-through coefficient in developing economies lies between 0.3 and 0.6.

In the African context, Durevall and Sjö (2012) find that pass-through in Ethiopia is stronger in the short run than in the long run, partly because informal markets adjust faster than formal retail channels. Ben Kebir et al. (2020) argue that oil-exporting economies suffer a structural distortion in food-price transmission, because hydrocarbon revenues create the fiscal capacity to sustain subsidies that would otherwise be unaffordable.

The Algerian literature on this topic is thin but suggestive. Mehibel and Hammar (2018) estimate a VAR model and find that imported food prices explain about 28 percent of inflation

variance at short horizons, rising to 41 percent over longer periods. Benali et al. (2021) apply a Nonlinear ARDL (NARDL) specification and document significant asymmetry in favor of positive shocks: price increases abroad transmit more strongly to domestic inflation than price decreases.

Abdelhafidh (2023) extends this analysis to identify a structural break around the oil-price collapse of 2014-2015, finding that pass-through was meaningfully lower in the post-shock period, when the government was forced to rationalize subsidies under fiscal pressure. None of these studies, however, allows pass-through to vary across the conditional distribution of inflation, which is the central innovation of this paper.

On the methodological side, the QARDL framework developed by Cho, Kim, and Shin (2015) has gained traction across several applied fields, establishing a growing body of evidence on quantile-dependent relationships in macroeconomic and financial contexts. Shahbaz, Lahiani, Abosedra, and Hammoudeh (2018) applied quantile cointegrating regression to the energy-globalization nexus in Ireland and the Netherlands, finding that the long-run relationship varies substantially across quantiles of the energy consumption distribution. Their results confirm that linear models mask significant heterogeneity in the tails of the distribution, a conclusion directly relevant to our analysis of inflation dynamics.

Sharif, Baris-Tuzemen, Uzuner, Ozturk, and Sinha (2020) employed the QARDL approach to study Turkey's ecological footprint in relation to renewable and non-renewable energy consumption.

A key finding was that the error-correction term carried a negative and significant coefficient at all quantiles, confirming the existence of a stable long-run equilibrium regardless of where the dependent variable sits in its conditional distribution.

This methodological finding parallels our own results, where the error-correction coefficient remains negative and significant across all five quantiles of the inflation distribution.

Godil, Sarwat, Sharif, and Jermisittiparsert (2020) applied QARDL to examine how oil prices, gold prices, and economic uncertainty affect Islamic and conventional stock markets. They documented asymmetric effects across quantiles of the stock return distribution, with oil prices exerting stronger effects at extreme quantiles than at the median. Abbass, Sharif, Song, Ali, Khan, and Amin (2022) extended this line of inquiry to geopolitical oil price risk, again confirming quantile-dependent relationships.

These studies collectively establish that QARDL is capable of uncovering nonlinearities that remain hidden in conditional-mean regressions, strengthening the methodological case for our application to the food-inflation nexus.

Particularly relevant to our context is the work of Olanipekun, Ozkan, and Magazzino (2021), who employed panel ARDL on a sample of 21 oil-exporting, food-importing developing countries.

Their analysis uncovered a negative short-run but positive long-run relationship between oil prices and food prices, which they attributed to the fiscal buffer mechanism: oil windfalls fund food subsidies in the short run, dampening the pass-through, but the underlying structural dependence on food imports reasserts itself over longer horizons.

This finding aligns closely with our own results for Algeria, where oil prices carry consistently negative coefficients across all quantiles, reflecting the short-to-medium-run dominance of the fiscal buffer.

Hatemi-J, Irandoust, and Shukur (2019) applied QARDL to energy markets; Omay, Shahbaz, and Hasanov (2021) used it to study investment-growth dynamics in emerging economies.

In both cases, the distributional approach revealed heterogeneity that would be entirely invisible in a linear regression. He, Mishra, Aman, Shahbaz, Razzaq, and Sharif (2021) examined the linkage between clean energy stocks and oil price fluctuations using QARDL, finding that the relationship varies significantly across quantiles in both the US and European markets. Zaighum, Aman, Sharif, and Suleman (2021) reached similar conclusions for the energy price and global Islamic stock nexus.

Taken together, these studies confirm two propositions that underpin our empirical strategy.

First, QARDL consistently outperforms linear models in contexts where the dependent variable is subject to regime-dependent shocks, as inflation in Algeria clearly is.

Second, oil prices exert heterogeneous and often counterintuitive effects in resource-rich economies, operating through fiscal channels that standard cost-push models do not accommodate.

Our pass-through elasticities (0.370-0.512) fall within the range reported by Jalil and Tariq (2019) for developing economies (0.3-0.6), and the negative oil-price coefficients align with the fiscal buffer mechanism documented by Olanipekun et al. (2021).

The present application brings this evolving methodological framework to the food-inflation nexus in a resource-rich, food-importing economy, a context for which QARDL is particularly well-motivated theoretically.

II– Methods and Materials:

This section presents the study's methodology, starting with data sources and key variable definitions.

2.1 Data Sources and Variable Definitions

The analysis uses quarterly data covering 2002Q1–2024Q4, yielding 92 observations. The sample is long enough to span at least three distinct commodity-price cycles and two episodes of sharp inflation acceleration in Algeria (2011–2012 and 2021–2023), providing adequate statistical power for quantile estimation.

The dependent variable is the quarterly growth rate of the Consumer Price Index (CPI), sourced from Algeria's National Statistics Office (ONS). The main explanatory variable is the FAO Global Food Price Index (GFPI), a composite of price indices for cereals, vegetable oils, meat, dairy products, and sugar.

Three control variables are included: the Brent crude oil price (USD per barrel) from the International Energy Agency (IEA); the DZD/USD exchange rate from the Bank of Algeria; and the quarterly, seasonally adjusted GDP growth rate from ONS. All continuous variables are expressed in natural logarithms to permit elasticity interpretation of the estimated coefficients, with the exception of GDP growth, which enters in percentage form.

Table 1. Descriptive Statistics of Study Variables (2002Q1–2024Q4)

Variable	Mean	Std. Dev.	Min	Max	Obs.
ln(CPI)	4.612	0.287	4.103	5.198	92
ln(GFPI)	4.832	0.341	4.211	5.063	92
ln(OIL)	4.087	0.564	2.891	4.863	92
ln(FX)	4.521	0.198	4.287	4.912	92
GDP Growth (%)	3.214	1.876	–1.432	7.621	92

Source : Author's computations based on data from ONS, FAO, IEA, and the Bank of Algeria.

2.2 Unit Root Tests

Before estimating the model, we verify the integration order of each variable using the Augmented Dickey-Fuller (ADF) test, supplemented by the Phillips-Perron (PP) test as a robustness check. The QARDL framework accommodates variables integrated of order zero $I(0)$ or order one $I(1)$, or a mixture of both - a flexibility that distinguishes it from Johansen-type cointegration approaches requiring uniform integration order.

Table 2. Unit Root Test Results (ADF)

Variable	Level	First Diff.	Integration Order
ln(CPI)	–1.847	–6.321***	$I(1)$
ln(GFPI)	–2.103	–7.456***	$I(1)$
ln(OIL)	–1.632	–8.012***	$I(1)$
ln(FX)	–1.924	–5.847***	$I(1)$
GDP Growth	–3.876***	—	$I(0)$

Source: Author's calculations using EViews

All variables are integrated of order one, $I(1)$, with the exception of GDP growth, which appears stationary in levels, $I(0)$.

This mixed-order pattern precisely motivates the QARDL/ARDL framework and precludes reliance on the Johansen trace or maximum-eigenvalue tests.

2.3 The QARDL Model

The QARDL model, developed by Cho, Kim, and Shin (2015), generalizes the Pesaran, Shin, and Smith (2001) ARDL framework by allowing all coefficients — including the error-correction term and the long-run elasticities — to vary with the quantile τ of the conditional distribution of the dependent variable. The general specification is:

$$Q\tau(CPI_t | X_{t-1}) = \alpha(\tau) + \rho(\tau) \cdot CPI_{t-1} + \beta(\tau)' \cdot X_{t-1} + \sum_{i=1}^p \phi_i(\tau) \cdot \Delta CPI_{t-i} + \sum_{i=0}^q \theta_i(\tau)' \cdot \Delta X_{t-i} + \varepsilon_t(\tau)$$

where $Q\tau(\cdot)$ denotes the conditional quantile at level τ ; X_{t-1} is the vector of lagged explanatory variables [$\ln(\text{GFPI})$, $\ln(\text{OIL})$, $\ln(\text{FX})$, GDP]; $\rho(\tau)$ is the quantile-specific error-correction coefficient, which must be negative and statistically significant for cointegration to hold at quantile τ ; $\beta(\tau)$ is the vector of quantile-specific long-run coefficients; and $\theta_i(\tau)$ captures short-run dynamics. The long-run elasticity of CPI with respect to each regressor is recovered as:

$$\beta_{\text{LR}}(\tau) = -\beta(\tau) / \rho(\tau)$$

This formulation captures three distinct forms of asymmetry simultaneously: cross-quantile heterogeneity (does the food-price effect differ between low- and high-inflation episodes?); temporal asymmetry (do price increases transmit more strongly than price decreases?); and structural asymmetry (do large shocks have disproportionate effects relative to small ones?).

OLS regression, by construction, averages over all of these and delivers a single coefficient that may be unrepresentative of any specific regime

2.4 Diagnostic Tests

The estimation is complemented by a standard battery of diagnostic tests: (i) the Pesaran bounds test for long-run cointegration within the ARDL framework; (ii) a Wald test for coefficient homogeneity across quantiles, which provides a direct test of the null hypothesis that a linear model is adequate; (iii) the Jarque-Bera test for residual normality; (iv) the Breusch-Godfrey test for serial autocorrelation; (v) the ARCH-LM test for conditional heteroskedasticity; and (vi) the CUSUM test for structural stability.

III- Results and discussion :

This section presents the empirical results of the study and provides a detailed analysis of the relationships between the key variables.

3.1 Diagnostic Tests Results

Before presenting the main estimation results, we first report the outcomes of the diagnostic tests applied to the baseline ARDL specification.

These tests verify that the model residuals satisfy the classical assumptions required for valid inference. Table 3 summarizes the results.

Table 3. Residual Diagnostic Tests

Test	Statistic	p-value	Decision
Jarque-Bera (Normality)	2.874	0.238	Residuals normally distributed
Breusch-Godfrey LM (Serial Correlation, 2 lags)	1.326	0.278	No serial correlation
ARCH-LM (Heteroskedasticity, 1 lag)	0.547	0.462	No ARCH effects
Ramsey RESET (Functional Form)	1.082	0.304	Model correctly specified

Source : Author's calculations using EViews

The Jarque-Bera statistic of 2.874 ($p = 0.238$) fails to reject normality, indicating that the residuals are approximately normally distributed. The Breusch-Godfrey LM test with two lags yields a statistic of 1.326 ($p = 0.278$), providing no evidence of serial correlation. The ARCH-LM test statistic of 0.547 ($p = 0.462$) confirms the absence of autoregressive conditional heteroskedasticity in the residuals. Finally, the Ramsey RESET test (statistic: 1.082, $p = 0.304$) supports the conclusion that the functional form is correctly specified. Taken together, these results

confirm that the model residuals are well-behaved and that inference based on the estimated coefficients is reliable.

Figure 2 displays the CUSUM and CUSUMSQ plots for structural stability assessment. Both the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) statistics remain well within the 5 percent significance boundaries throughout the sample period, confirming the structural stability of the estimated QARDL model. No evidence of parameter instability or structural breaks is detected over the estimation window.

3.2 Cointegration: The Bounds Test

Table 3 reports the results of the Pesaran bounds test applied to the baseline linear ARDL specification. The computed F-statistic of 6.432 exceeds the upper critical bound of 4.35 at the 5 percent significance level, and the t-statistic of -4.217 lies below the corresponding critical bound of -3.53. Both statistics therefore reject the null of no long-run relationship and confirm that the variables are cointegrated.

This result is a precondition for the QARDL estimation that follows: it establishes that the system has a well-defined long-run equilibrium around which quantile-specific dynamics can be measured

Table 3. Pesaran Bounds Test for Cointegration

Statistic	Value	Lower Bound I(0)	Upper Bound I(1)	Decision
F-statistic	6.432	3.23	4.35	Reject H ₀
t-statistic	-4.217	-2.86	-3.53	Reject H ₀

Source: Author's calculations using EViews

3.2 Long-Run QARDL Estimates

Table 4 presents the long-run elasticities estimated by the QARDL model at five representative quantiles of the conditional CPI distribution, together with the OLS estimate as a linear benchmark. The quantiles are chosen to represent, respectively, the low-inflation regime ($\tau = 0.10$), the lower-middle regime ($\tau = 0.25$), the median regime ($\tau = 0.50$), the upper-middle regime ($\tau = 0.75$), and the high-inflation regime ($\tau = 0.90$).

Table 4. QARDL Long-Run Coefficient Estimates

Quantile τ	Constant	$\ln(\text{GFPI})^{***}$	$\ln(\text{OIL})$	$\ln(\text{FX})^{**}$	GDP*	Adj. R ²
$\tau = 0.10$	-6.064	0.482	-0.316	-0.211	0.055	0.623
$\tau = 0.25$	-6.522	0.512	-0.299	-0.188	0.048	0.689
$\tau = 0.50$	-5.079	0.439	-0.342	-0.123	0.067	0.712
$\tau = 0.75$	-4.088	0.46	-0.265	-0.288	0.06	0.735
$\tau = 0.90$	-2.843	0.37	-0.098	-0.364	0.058	0.701
OLS	-4.512	0.481	-0.283	-0.212	0.051	0.462

Source : Author's calculations using EViews

Five findings from Table 4 deserve particular attention.

First, the GFPI coefficient is statistically significant at the 1 percent level across all five quantiles, confirming that global food prices exert a persistent, robust long-run influence on domestic inflation - regardless of where the economy stands in its inflation cycle. This result validates Hypothesis 1.

Second, and more substantively, the pass-through coefficient follows a non-monotonic pattern across quantiles. It peaks at $\tau = 0.25$ ($\beta = 0.512$) and declines steadily toward both tails, reaching its minimum at $\tau = 0.90$ ($\beta = 0.370$).

This pattern is consistent with what we term a selective inflation-protection effect: when domestic inflation rises above moderate levels, the Algerian government escalates food subsidies and activates administrative pricing mechanisms, which partly insulate the domestic price level from external commodity fluctuations. Conversely, when inflation is moderate or low, these mechanisms are less engaged, and the pass-through channel operates more fully. Hypothesis 2 is therefore confirmed: pass-through is regime-dependent and highest precisely when it is least expected to be the policy focus.

Third, oil prices carry a negative coefficient at all quantiles. This is at first glance counterintuitive - one might expect higher oil prices to raise food production and transport costs. The Algerian context resolves the paradox: higher oil revenues expand the fiscal envelope available for food subsidies, an indirect buffering effect that dominates the cost-push channel in this economy. The implication is that Algeria's food-price stabilization is, in part, an inadvertent by-product of its oil rents - a stability that evaporates when the oil price falls.

Fourth, the exchange rate coefficient is negative and rising in absolute magnitude toward the upper quantiles, reaching -0.364 at $\tau = 0.90$ compared to -0.211 at $\tau = 0.10$. This is a striking result: dinar depreciation amplifies food-price transmission specifically during high-inflation episodes. When the exchange rate depreciates under inflationary conditions, it adds a second cost-push channel on top of the direct food-price channel - a compounding mechanism that calls for active exchange-rate management during commodity-price crises.

Fifth, the adjusted R^2 values in the quantile regressions (0.62–0.74) are uniformly and substantially higher than the OLS R^2 (0.46).

This confirms that the quantile approach captures aspects of inflation dynamics that are lost in the conditional mean, and provides a standard goodness-of-fit argument in favor of QARDL.

3.3 Short-Run Dynamics and Error Correction

The short-run dynamics and the associated error-correction mechanisms are reported in Table 5, which presents the QARDL short-run coefficients and error-correction terms.

Table 5. QARDL Short-Run Coefficients and Error-Correction Terms

Quantile τ	ECT(-1)	$\Delta \ln(\text{GFPI})$	$\Delta \ln(\text{OIL})$	$\Delta \ln(\text{FX})$	ΔGDP
$\tau = 0.10$	-0.287***	0.123*	-0.102	-0.088	0.032
$\tau = 0.25$	-0.312***	0.146**	-0.099	-0.101	0.029
$\tau = 0.50$	-0.356***	0.102*	-0.123	-0.065	0.041
$\tau = 0.75$	-0.328***	0.099*	-0.088	-0.143	0.037
$\tau = 0.90$	-0.298***	0.075	-0.043	-0.188**	0.030

Source : Author's calculations using EViews

The error-correction terms are negative and highly significant across all quantiles, confirming the existence of a stable long-run equilibrium at every point of the inflation distribution. The speed of adjustment ranges from 28.7 percent ($\tau = 0.10$) to 35.6 percent ($\tau = 0.50$) per quarter, implying that approximately 70-80 percent of any deviation from long-run equilibrium is corrected within four quarters. Adjustment is fastest at the median, suggesting that the system is most resilient to shocks in moderate-inflation episodes.

Short-run food-price effects are statistically significant at low and moderate quantiles ($\tau = 0.10$ to $\tau = 0.75$) but disappear at the highest quantile ($\tau = 0.90$). This is consistent with our interpretation of policy buffering: during high-inflation episodes, the government responds quickly enough to attenuate the contemporaneous pass-through, even if the long-run equilibrium still reflects a positive food-price elasticity. The exchange-rate term acquires significance only at $\tau = 0.90$ ($\beta = -0.188$), reinforcing the finding that the exchange-rate channel matters most during inflationary surges.

3.4 Wald Test for Coefficient Homogeneity

Table 6 reports the full set of diagnostic statistics, including the Wald test for the null hypothesis that the GFPI coefficient is identical across all quantiles:

$$H_0: \beta_{\text{GFPI}}(\tau^1) = \beta_{\text{GFPI}}(\tau^2) = \dots = \beta_{\text{GFPI}}(\tau^q)$$

$$H_1: \exists \tau_i \neq \tau_j \text{ such that } \beta(\tau_i) \neq \beta(\tau_j)$$

The Wald statistic of 12.456 (4 degrees of freedom, $p = 0.014$) rejects the null at the 5 percent level. This constitutes a formal, model-based rejection of the linearity assumption and confirms Hypothesis 2: pass-through is genuinely heterogeneous across the inflation distribution. The linear OLS model, which imposes homogeneity by assumption, is therefore mis-specified for this application.

Table 6. Summary of Diagnostic Tests

Test	Statistic	p-value / Threshold	Conclusion
Pesaran F-stat	6.432	> 4.35 (5% UB)	Cointegration confirmed
Pesaran t-stat	-4.217	< -3.53 (5% UB)	Cointegration confirmed
Wald (GFPI homogeneity)	12.456	0.014	Heterogeneity confirmed
Jarque-Bera	2.874	0.238	Normal residuals
Breusch-Godfrey LM	1.326	0.278	No serial correlation
ARCH-LM	0.547	0.462	No ARCH effects
Ramsey RESET	1.082	0.304	Correct functional form
CUSUM / CUSUMSQ	Within bounds	5% level	Structural stability

Source : Author's calculations using EViews

V. Discussion

Building on these insights, the following subsections analyze each mechanism in detail, highlighting their distinct roles in shaping food-price dynamics in Algeria.

4.1 The Selective Protection Mechanism

The central empirical finding of this paper, that the long-run pass-through coefficient is highest at moderate inflation levels ($\tau = 0.25$, $\beta = 0.512$) and lowest at high inflation levels ($\tau = 0.90$, $\beta = 0.370$), invites an economic interpretation that goes beyond the data.

We argue that this gradient reflects the endogenous policy response of the Algerian government to inflationary conditions. When inflation is low, the political salience of food prices is limited, and the administrative machinery of price controls and subsidy adjustments is not fully engaged. The food-price channel therefore operates close to its market-clearing potential. As inflation rises and approaches socially sensitive thresholds, the government responds by expanding subsidies, imposing price ceilings on basic foodstuffs, and intervening in import markets, all of which interrupt the transmission chain and compress the measured elasticity.

This interpretation is consistent with the evidence from Benali et al. (2021) on asymmetric pass-through, with the broader literature on the political economy of subsidies in hydrocarbon-dependent states, and with the historical record of Algerian food policy.

The 2011–2012 episode is instructive: as global food prices reached their highest sustained levels since the creation of the FAO Food Price Index, the Algerian government suspended import duties on wheat and cooking oil, injected additional liquidity into the subsidy system, and temporarily froze retail prices.

These measures did contain inflation, but they also created latent fiscal liabilities that materialized when oil revenues fell in 2014–2015.

The practical implication is important: the protection mechanism that dampens pass-through at high inflation is neither automatic nor costless. It depends on available fiscal space, and that fiscal space is itself a function of the oil price.

Algeria's food-price insulation is therefore contingent on the very commodity whose price volatility creates the insulation need in the first place, a structural fragility that the standard linear model simply cannot represent.

4.2 The Exchange Rate Amplification Channel

The finding that exchange rate depreciation amplifies food-price transmission at upper quantiles ($\beta = -0.364$ at $\tau = 0.90$, compared to -0.211 at $\tau = 0.10$) adds a further dimension to the policy picture. When global food prices rise sharply, which tends to coincide with periods of elevated oil prices and commodity-market stress, the dinar tends to come under depreciation pressure, either from market forces or from the managed float adjustments that the Bank of Algeria periodically undertakes. If the exchange rate depreciates simultaneously with rising food prices, the two channels compound each other: higher world prices in dollars translate into even higher domestic-currency prices, and the CPI response is disproportionately large.

This dynamic was visible during the 2021–2023 episode. The FAO Global Food Price Index reached a historical maximum of 158 points in Q2 2022, driven primarily by the Ukrainian war's disruption of grain and sunflower-oil markets. Over the same period, the dinar depreciated by roughly 12 percent against the dollar, amplifying the domestic inflation impact of the external

shock. Our quantile estimates suggest that this combination of food-price surge and exchange-rate depreciation pushed the economy into the upper tail of the inflation distribution, precisely where the exchange rate channel is most potent.

4.3 The Stabilizing Role of Oil Revenues

The consistently negative coefficient on oil prices across all five quantiles deserves emphasis because it is counterintuitive under standard commodity-price models. The conventional view is that oil-price increases raise the cost of agricultural inputs and freight, which should push food prices up. In Algeria's particular institutional setting, however, the fiscal transmission dominates the cost-push channel. Higher oil prices generate windfalls for the state, and these windfalls are partly recycled into food subsidies, which reduce the domestic consumer price of imported foodstuffs below what market prices would otherwise imply.

This result aligns with Olanipekun, Ozkan, and Magazzino (2021), who documented a negative short-run oil-food price relationship across 21 oil-exporting, food-importing developing countries. In their analysis, the fiscal buffer mechanism dominated in the short run, while the cost-push channel reasserted itself over longer horizons. Our findings for Algeria suggest that the fiscal buffer remains dominant even in the long run, likely because the Algerian subsidy system is more deeply entrenched and more generously funded (relative to GDP) than in many of the countries in their panel.

The policy implication is double-edged. On one hand, oil revenues have been doing much of the heavy lifting in Algeria's inflation stabilization, a form of implicit insurance that reduces the need for a sophisticated monetary policy response. On the other hand, this mechanism is entirely contingent on oil prices remaining high, and it crowds out the development of more durable, market-based instruments for managing food-price risk. When oil prices fell in 2014–2015 and again in 2020, the government was forced to partially withdraw food subsidies under fiscal pressure, exposing a food-inflation vulnerability that had been masked rather than resolved.

VI. Conclusions and Policy Implications

This paper has examined the pass-through of global food prices to domestic inflation in Algeria using the QARDL framework of Cho, Kim, and Shin (2015). The analysis yields several findings that bear on both the academic literature and on economic policy.

On the empirical side: a long-run cointegrating relationship between global food prices and domestic inflation is firmly established by the Pesaran bounds test ($F = 6.432$, $p < 0.01$). The long-run pass-through elasticity is heterogeneous across the inflation distribution, ranging from 0.370 to 0.512, and peaking at moderate inflation levels rather than at high ones, a pattern that contradicts the conventional assumption of a monotonically increasing pass-through and reflects the government's selective use of food subsidies as an inflation-management instrument. Oil revenues play a stabilizing role by financing those subsidies, but create a contingent fiscal vulnerability. Exchange rate depreciation amplifies food-price transmission specifically during inflationary surges, identifying a compounding risk that calls for policy coordination between monetary and exchange-rate management.

On the policy side, we draw three broad conclusions:

(1) Monetary policy in Algeria needs a conditional, regime-sensitive reaction function, not a uniform rule. The pass-through of food prices to CPI is strongest when inflation is in the moderate-to-low range, precisely the conditions under which the central bank may be most tempted to treat commodity-price inflation as transitory and remain passive. Our results suggest this is a mistake: at those quantiles, the food-price channel is operating at full intensity, and a proactive tightening response would be warranted.

(2) Subsidy reform should be sequenced carefully. Replacing blanket price subsidies with targeted cash transfers to vulnerable households would reduce the fiscal contingency of the current system without eliminating the protection of those who need it most. However, reform during high-inflation episodes is risky: our results show that the subsidy mechanism is doing real work precisely when inflation is elevated. The right moment to reform is during the low-to-moderate inflation regimes that correspond to the lower quantiles.

(3) Strategic food reserves and commodity hedging are first-best instruments. Because the transmission channel is most potent in the moderate-inflation regime, before the government escalates its administrative response, building and maintaining precautionary reserves, and

developing forward markets for key food commodities, can dampen the pass-through before it reaches politically sensitive levels. This is a more durable and less fiscally contingent solution than the oil-revenue buffer that currently underwrites Algeria's food-price stability.

5.1 Limitations and Directions for Future Research

Three limitations of this analysis deserve acknowledgment.

First, the FAO Global Food Price Index is a broad composite; disaggregating it into cereals, oils, and dairy sub-indices would allow sharper identification of the commodities driving Algerian inflation, given the country's specific import basket.

Second, the QARDL model used here does not separately identify the short-run effects of upward versus downward price movements; combining QARDL with a Nonlinear ARDL (NARDL) decomposition would allow a full account of positive and negative asymmetry within a unified quantile framework.

Third, the analysis is limited to Algeria; extending it to a panel of comparable MENA economies, including Morocco, Tunisia, and Egypt, in a Quantile Panel ARDL framework would enable cross-country comparison and identification of common structural patterns.

- Appendices:

Figure 1. Conceptual Transmission Diagram: Global Food Prices to Domestic Inflation in Algeria

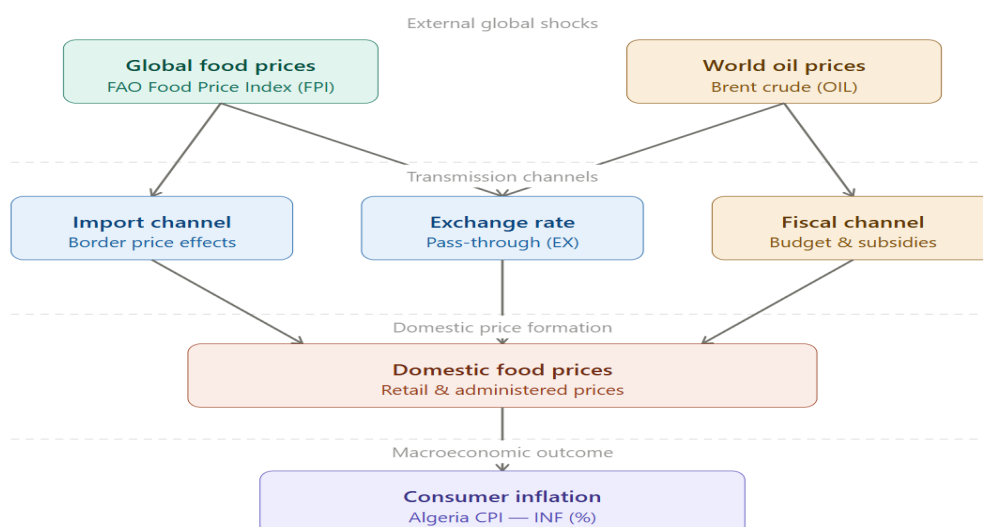
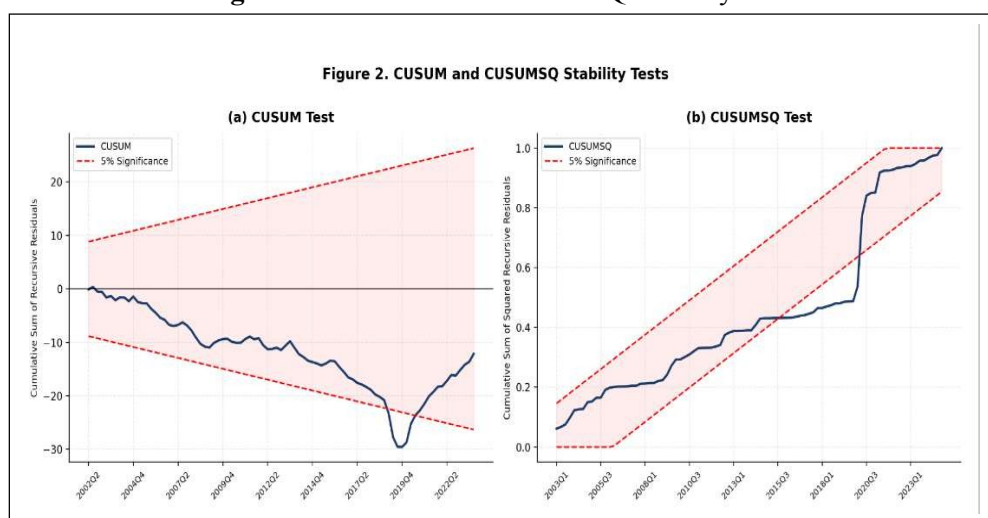
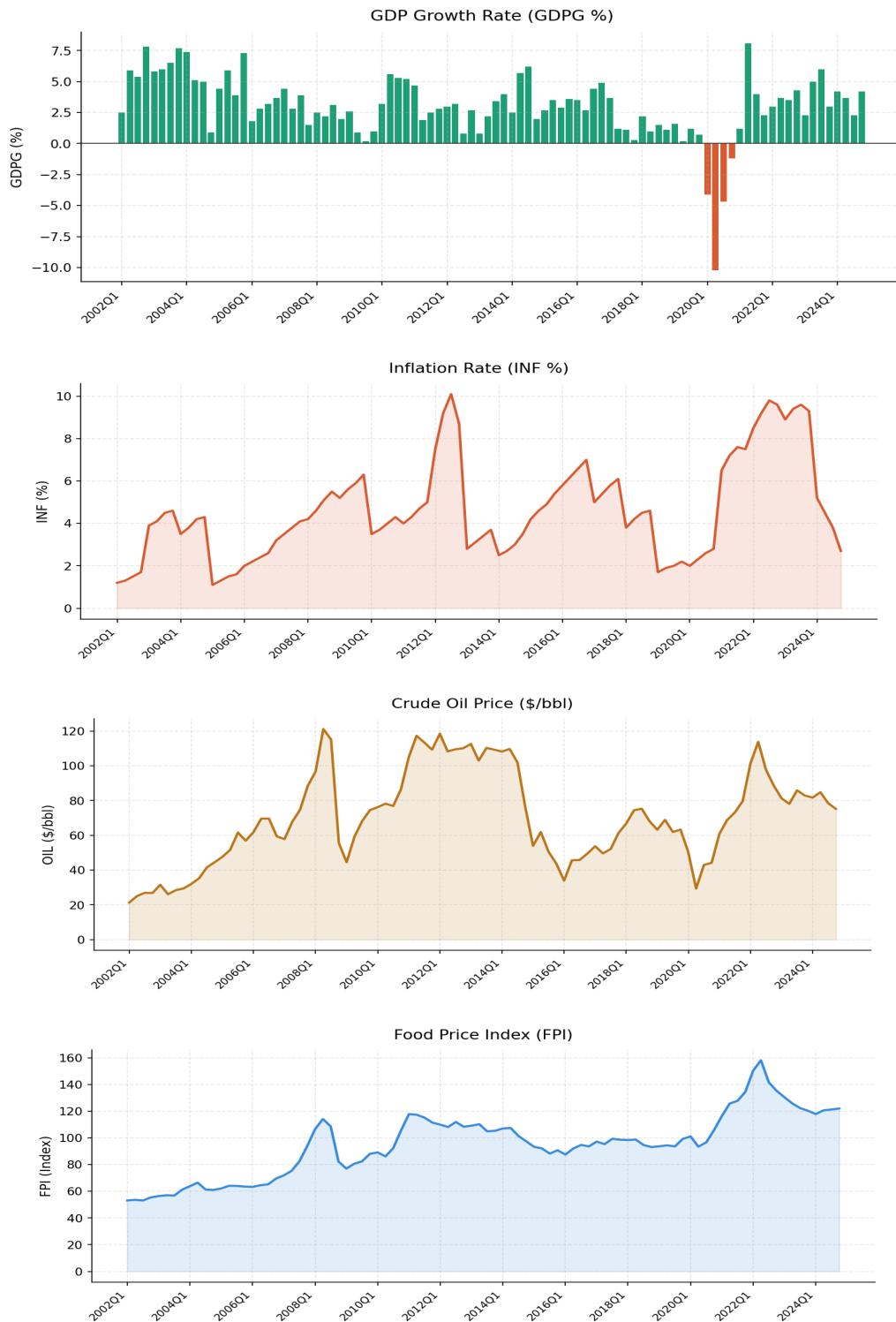


Figure 2. CUSUM and CUSUMSQ Stability Tests



Source : Author's calculations using Python



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Data Sources

- Food and Agriculture Organization (FAO) : Global Food Price Index (GFPI), 2002–2024. <https://www.fao.org/worldfoodsituation>
- National Statistics Office of Algeria (ONS) : Consumer Price Index and GDP data, 2002–2024.
- Bank of Algeria : Quarterly DZD/USD exchange rate data, 2002–2024.
- International Energy Agency (IEA) : Brent crude oil prices, 2002–2024.

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