Market Unity Amidst Conflict: Price Integration Analysis in Yemen

An Econometric and Spatial Approach

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Research Context

Study Focus:

- Analysis of market integration between Aden and Sana'a
- Price transmission in staple commodity markets
- Impact of conflict on market dynamics

Key Challenges:

- Protracted conflict
- Institutional fragmentation
- Dual exchange rate regime
- Infrastructure limitations

Long-run Market Integration

Long-run Price Relationship:

$$P_{it} = \alpha_0 + \alpha_1 P_{jt} + u_t$$

Interpretation:

- P_{it}: Price in Aden at time t
- P_{jt}: Price in Sana'a at time t
- α_0: Transaction costs between markets
- α_1: Price transmission elasticity
    - $\alpha_1 = 1$: Perfect market integration
    - $0 < \alpha_1 < 1$: Partial integration
    - $\alpha_1 = 0$: No integration
- u_t: Deviations from equilibrium

Error Correction Dynamics

Error Correction Model:

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \delta Z_t + \varepsilon_t$$

where:

- ΔX_t: Price changes in both markets
- α: Speed of adjustment to equilibrium
- β': Long-run equilibrium relationship
- Γ_i: Short-term price responses
- Z_t: External factors (conflict, exchange rates)
- ε_t: Random shocks

Spatial Analysis Framework

1. Spatial Weights Matrix:

$$w_{ij} = \begin{cases} 1 & \text{if } j \text{ is among } k \text{ nearest neighbors of } i \\ 0 & \text{otherwise} \end{cases}$$

where:

- w_{ij}: Market connectivity measure
- k: Number of connected markets
- Captures geographic market networks

Spatial Price Models

Spatial Models:

$$\text{SLM: } y = \rho W y + X\beta + \varepsilon$$
$$\text{SEM: } y = X\beta + u, \quad u = \lambda W u + \varepsilon$$

where:

- y: Vector of market prices
- W: Market connectivity matrix
- ρ: Strength of price spillovers
- λ: Spatial error correlation
- X: Market characteristics
- β: Impact of characteristics

Time-Varying Integration

Dynamic Integration Index:

$$y_t = \alpha_t + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2)$$
$$\alpha_t = \alpha_{t-1} + \eta_t, \quad \eta_t \sim N(0, \sigma_\eta^2)$$

where:

- y_t: Market price differential
- α_t: Time-varying integration level
- ε_t, η_t: Market shocks
- Captures evolving integration patterns

Price Differential Analysis

Price Gap Model:

$$\Delta P_{ijt} = \alpha + \beta_1 D_{ij} + \beta_2 C_{ijt} + \beta_3 E_t + \varepsilon_{ijt}$$

where:

- ΔP_{ijt}: Price gap between markets
- D_{ij}: Transportation distance
- C_{ijt}: Conflict intensity
- E_t: Exchange rate differences
- Measures barriers to integration

Cointegration Results:

- Strong long-run equilibrium relationships
- Significant bidirectional price transmission
- Varying adjustment speeds across commodities

Price Transmission:

- Robust error correction mechanisms
- Asymmetric adjustment patterns
- Impact of exchange rate volatility

Staple Foods:

- Beans: Strong cointegration ($\alpha \approx 0.896$)
- Eggs: Rapid adjustment ($\alpha = 1.224$)
- Wheat: Significant price transmission

Imported Goods:

- Fuel: Varying degrees of adjustment
- Rice: Significant ECM coefficients
- Impact of dual exchange rates

Policy Implications

Strategic Recommendations:

- Exchange rate unification efforts
- Infrastructure enhancement
- Market information systems

Integration Enhancement:

- Strengthen Aden-Sana'a corridor
- Reduce transaction costs
- Improve market efficiency

Conclusions

Key Contributions:

- Evidence of market resilience
- Quantification of integration patterns
- Framework for policy intervention

Future Directions:

- Enhanced market monitoring
- Targeted integration strategies
- Conflict-sensitive approaches