

The Price of Isolation: Sanctions, Supply Shocks, and Price Discovery Dynamics in Russia's Crude Oil Market

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ABSTRACT

This study examines how intensifying Western sanctions, Central Bank of Russia (CBR) monetary tightening, and OPEC+ supply management reshaped price discovery dynamics in Russia's crude oil market during 2025-2026. Applying a noise-robust information share (IS) framework to a six-factor Russian-centric panel (CBR Key Rate, RUB/USD exchange rate, OPEC+ supply, geopolitical risk index, sanctions proxy, and AI CapEx Index) across 63 weekly observations, we find that price discovery has become internally isolated from global commodity benchmarks. The sanctions proxy dominates information shares (22.4%), followed by OPEC+ supply (19.8%), RUB/USD exchange rate (17.3%), and CBR key rate (14.7%). A stark absorption asymmetry emerges: OPEC+ quota decisions are priced within 3.8 trading days, whereas sanctions enforcement shocks persist for 14.7 days. IV/GMM noise-robust bias correction reveals a +63.7% OLS underestimate for the Sanctions Proxy, confirming that standard models systematically misattribute shadow fleet friction costs as informational absence. Shadow fleet logistics costs reached \$773 million (6.7-8.1% of cargo value) in early 2026. The Urals-Brent discount is projected at \$22/bbl for Q2 2026, reflecting a structural isolation premium that implies annual revenue losses of \$7-12 billion. Policy implications highlight benchmark standardisation, intensified OPEC+ engagement, and accelerated technology import substitution as priority responses.

Keywords: Price Discovery, Information Share, Sanctions, Central Bank of Russia Key Rate, Russian Oil Exports, OPEC+, Regime Switching, Price Cap, IV/GMM

JEL Classifications: Q41, Q43, F51, G14, E52

1. INTRODUCTION

The Russian oil market in 2025-2026 operates in a state of structural isolation unprecedented in modern commodity history. Cut off from mainstream Western financial and insurance infrastructure by G7 price caps and EU embargoes, Russia's export mechanism has mutated into a shadow system characterised by opaque pricing, alternative logistics, and distinct macroeconomic feedback loops. This isolation has fundamentally altered the price discovery process: Global signals such as Federal Reserve interest rates and DXY fluctuations have receded in relevance, replaced by domestic drivers such as the Central Bank of Russia (CBR) key rate and the RUB/USD exchange rate. For Russia, the stakes are existential: hydrocarbon revenues accounted for 30.3% of

federal budget receipts in 2023 (Fekline, 2024; Russian Ministry of Finance, 2025), making the precise mechanism of Urals price formation a matter of national fiscal stability.

The primary feature of this new environment is the decoupling of Russian oil prices from transparent global benchmarks. While Brent crude responds to global demand signals, Urals prices are increasingly determined by the friction of sanctions enforcement and the costs of shadow-fleet logistics (Babina et al., 2023; Kilian et al., 2024). The CBR's monetary policy has become reactive to this dynamic: as sanctions tighten and discounts widen, the CBR raises the key rate defensively to stabilise the ruble and curb inflation driven by import costs, creating a direct transmission channel from oil market friction to domestic monetary tightness.

This study investigates these dynamics by applying the noise-robust information share (IS) estimator of Fruet Dias et al. (2026). Unlike conventional methods, this approach explicitly corrects for microstructural noise introduced by opaque shadow-fleet transactions. We construct a focused six-factor panel tailored specifically to the Russian context -- including the CBR Key Rate, RUB/USD Exchange Rate, and a proprietary Sanctions Proxy -- to isolate the true drivers of Urals price discovery. By centering the analysis on Russia's internal market reality rather than global macro abstractions, we demonstrate that the "noise" in Russian oil prices is not random error but the quantifiable cost of isolation.

2. LITERATURE REVIEW

The market structure for Russian Urals crude has undergone a radical transformation. Historically, Fedorova and Pankratov (2010) established that prior to 2014, Urals dynamics were almost perfectly integrated with Brent ($r = 0.94$). The post-2022 sanctions regime shattered this integration. Babina et al. (2023) document, using a comprehensive transaction-level dataset, that the 2022 G7 price cap and EU embargo forced Russian exporters to accept large, persistent Urals-Brent discounts. Kilian et al. (2024) quantify a peak discount of approximately USD 32/bbl in March 2023 - nearly half of the prevailing world price - which has since narrowed only partially due to shadow-fleet adaptation. Furthermore, the foundational concept that physical storage and transaction hurdles generate persistent friction has long been recognised (Working, 1949), though rarely applied to sanctions-induced logistics.

Methodologically, Hasbrouck (1995) defined the information share (IS) as the contribution of a market to the variance of the efficient price innovation. This measure was subsequently extended by Gonzalo and Granger (1995) through the permanent-transitory decomposition of cointegrated systems. Both approaches, however, assume clean and transparent price signals. Applied to sanctioned markets, standard IS estimates are biased by measurement noise. Fruet Dias et al. (2026) demonstrate that IV/GMM correction is essential when prices contain systematic noise - a condition perfectly describing the shadow-fleet dominated Urals market. Our study applies this correction to properly attribute price discovery between fundamental supply factors (OPEC+) and friction factors (sanctions), building also on the broader oil-shock macroeconomic literature (Hamilton, 2009).

3. ANALYTICAL FRAMEWORK

This section presents the complete econometric framework underlying the empirical analysis. The methodology proceeds in four stages: (1) cointegration testing to establish long-run price equilibrium; (2) VECM estimation to identify short-run dynamics and error-correction speed; (3) noise-robust information share estimation via IV/GMM; and (4) structural break identification via Bai-Perron testing. Each stage is formally defined below.

3.1. Long-Run Cointegrating Relationship

We begin by testing for a long-run equilibrium relationship

between the log of Urals crude prices and the log of Brent crude prices, conditioned on the six-factor vector of Russian market determinants. The long-run cointegrating equation is specified as:

$$\ln p_t^{Urals} = \beta_0 + \beta_1 \ln p_t^{Brent} + \gamma' X_t + \varepsilon_t \tag{1}$$

Where and denote the natural logarithms of weekly Urals and Brent prices respectively, X_t is the (6×1) vector of exogenous determinants (CBR Key Rate, RUB/USD, OPEC+ Supply, GPR Index, OFAC Designations, AI CapEx Index), γ is a conformable vector of long-run coefficients, and ε_t is the stationary error term representing transient price deviations. Cointegration is confirmed via the Johansen (1991) trace test (see Appendix C).

3.2. Johansen Cointegration Trace Test

The existence of the long-run relationship in Equation 1 is verified using the Johansen (1991) maximum likelihood trace statistic, which sequentially tests the null hypothesis that the cointegrating rank does not exceed r :

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \tag{2}$$

Where T is the sample size, n is the number of endogenous variables ($n = 2$ for log Brent and log Urals), and $\hat{\lambda}_i$ are the ordered eigenvalues. We test $H_0: \text{rank} \leq r$ against $H_1: \text{rank} > r$, starting at $r = 0$. Rejection of the $r = 0$ null confirms at least one stable long-run equilibrium price relationship.

3.3. Vector Error Correction Model (VECM)

Given confirmed cointegration, we estimate the full error correction dynamics using a VECM. The error correction term (ECT) represents the degree of disequilibrium from the long-run Brent-Urals relationship at each period:

$$\hat{\mu}_{t-1} = \ln p_{t-1}^{Urals} - \hat{\beta}_0 - \hat{\beta}_1 \ln p_{t-1}^{Brent} - \hat{\gamma}' X_{t-1} \tag{3}$$

The ECT captures the "isolation discount" embedded in Urals prices that persists above and beyond what Brent price movements alone would predict, given the current vector X_{t-1} of sanctions, monetary, and supply conditions.

The full VECM for the Urals price equation is then:

$$\Delta \ln p_t^{Urals} = \alpha \hat{\mu}_{t-1} + \sum_{k=1}^K \Gamma_k \Delta \ln p_{t-k} + \Phi \Delta X_t + u_t \tag{4}$$

Where α is the speed-of-adjustment coefficient (expected negative and significant for Urals), K is the VAR lag order selected via the Schwarz Bayesian Criterion ($SBC = 3$), γ_k are short-run dynamic matrices, Φ captures the contemporaneous impact of changes in the X_t determinants, and u_t is white noise. The alpha coefficient of -0.142 (see Appendix F) implies that approximately 14.2% of any deviation from the long-run equilibrium is eliminated each week, corresponding to a half-life of approximately 4.5 weeks.

3.4. Structural Break Identification (Bai-Perron)

To formally delineate the four structural regimes documented in

Section 4, we apply the multiple structural break test of Bai and Perron (2003). The test estimates m unknown breakpoints T_1, \dots, T_m by minimising the global sum of squared residuals across the following piecewise linear regression:

$$y_t = X_t' \beta_j + u_t, t = T_{j-1} + 1, \dots, T_j, j = 1, \dots, m + 1 \tag{5}$$

Where y_t is the Urals-Brent spread (the isolation discount), x_t includes the six market determinants, and β_j is the regime-specific coefficient vector for segment $j = 1, \dots, m + 1$. The Bai-Perron sequential F-test identifies $m = 3$ statistically significant breaks ($P < 0.05$), yielding four distinct regimes that correspond to escalating phases of sanctions enforcement. Trimming parameter $\varepsilon = 0.15$ and maximum breaks $m = 5$ are specified following Bai and Perron (2003).

3.5. Isolation Discount Decomposition

To further decompose the structural sources of the Brent-Urals spread, we estimate the following linear decomposition model. Let $D_t = p_t^{Brent} - p_t^{Urals}$ be the observed per-barrel discount. We attribute this discount to three latent channels:

$$D_t = p_t^{Brent} - p_t^{Urals} = \delta_S S_t + \delta_L L_t + \delta_R R_t + \xi_t \tag{6}$$

Where S_t is the Sanctions Channel (proxied by OFAC Designations), L_t is the Logistics Cost Channel (proxied by shadow fleet freight indices), R_t is the Revenue Conversion Channel (proxied by RUB/USD), and x_t is the residual (primarily OPEC + and demand effects). Coefficient estimates confirm that S_t explains the largest share of the structural discount ($\delta_S = 0.34$, $P < 0.001$), followed by L_t ($\delta_L = 0.21$, $P < 0.001$) and R_t ($\delta_R = 0.18$, $P < 0.001$).

3.6. Standard Hasbrouck Information Share

The information share (IS) framework of Hasbrouck (1995) attributes variance in the efficient (common) price component across n price series. For a system of $n = 2$ price series (Brent and Urals), the standard IS of market j is:

$$IS_j = \frac{([\Psi f]_j)^2}{\Psi(1)\Omega\Psi(1)'} \tag{7}$$

Where $[\Psi * f]_j$ is the j^{th} element of the row vector $\Psi(1)$ post-multiplied by the Cholesky factor f of the covariance matrix $\Omega = ff'$, and $\Omega = E[u_t u_t']$. The IS represents the fraction of the common efficient price variance attributable to price innovations in market j . By construction, IS values sum to unity across all n markets.

3.7. Noise Model and IV/GMM Bias Correction

Standard IS estimation assumes that observed prices equal efficient prices. In the Urals shadow market, observed prices embed systematic microstructure noise from opaque tanker transactions. Following Fruet Dias et al. (2026), we model observed prices as:

$$p_t = p_t^* + \eta_t \tag{8}$$

Where p_t^* is the latent efficient price, and η_t is i.i.d. measurement noise with variance σ_η^2 , representing the information friction introduced by shadow fleet opacity. This noise variance is identified via the IV/GMM estimator using lagged price differences as instruments.

The IV/GMM estimator exploits the following moment conditions, which are orthogonal to the measurement noise:

$$E[Z_t(\Delta p_t^{obs} - X_t' \beta)] = 0 \tag{9}$$

Where z_t is the $(q \times 1)$ instrument vector (lagged differences of observed prices at lags 2 through 5), x_t contains the VECM regressors, and β is the structural coefficient vector. The continuously updated GMM (CU-GMM) estimator minimises the GMM criterion function with an optimal weighting matrix updated at each iteration, delivering consistent and efficient estimates even under heteroskedastic noise.

3.8. Noise-Robust Information Share Estimator

The noise-robust information share (NR-IS) proposed by Fruet Dias et al. (2026) subtracts the estimated noise variance from both numerator and denominator of the standard IS formula, isolating the true signal component of each market's price innovation:]

$$IS_j^{NR} = \frac{[\Psi f]_j^2 - \hat{\sigma}_{\eta_j}^2}{\Psi \Omega \Psi' - \sum_{j=1}^n \hat{\sigma}_{\eta_j}^2} \tag{10}$$

Where $\hat{\sigma}_{\eta_j}^2$ is the IV/GMM estimate of the noise variance for market j , and all other notation follows Equation 7. The NR-IS is bounded on $[0, 1]$ and sums to unity across markets after noise subtraction. The key insight is that OLS-based IS conflates genuine price discovery (signal) with shadow fleet friction noise, leading to systematic underestimation of the Sanctions Proxy IS.

The magnitude of this bias for each factor is quantified as:

$$Bias_j(\%) = \frac{IS_j^{GMM} - IS_j^{OLS}}{IS_j^{OLS}} \times 100 \tag{11}$$

A bias of +63.7% for the Sanctions Proxy (Table 3) implies that OLS-based models attribute only 12.4% of price discovery to sanctions enforcement, whereas the true noise-corrected contribution is 20.3%. This is the central econometric finding of the study.

3.9. T_{90} Price Absorption Speed

To characterise the dynamics of information incorporation, we compute the T_{90} absorption speed for each factor j , defined as the number of trading days required for 90% of a structural shock's information to be reflected in the Urals price:

$$T_{90,j} = \frac{\ln(0.10)}{\ln(1 - \lambda_j)} \tag{12}$$

Where λ_j is the implied weekly decay rate of factor j 's impulse response function, derived from the VECM moving-average representation. A small T_{90} indicates rapid, efficient price absorption (e.g., OPEC+ quota announcements, $T_{90} = 3.8$ days); a large T_{90} indicates persistent uncertainty (e.g., sanctions enforcement, $T_{90} = 14.7$ days). This asymmetry reflects the fundamental difference between transparent, verifiable policy actions and ambiguous enforcement operations whose real-world impact on shadow logistics evolves over days to weeks.

Table 3 in Section 5 and Figure 1 present empirical T_{90} estimates across all six factors, stratified by regime to capture how absorption dynamics shift as sanctions escalate.

4. DATA AND VARIABLES

The dataset covers the period from January 2025 through March 2026 (63 weekly observations). Oil price data combines Argus Media assessments with synthetic FOB estimates derived from Indian import customs data to account for shadow fleet flows. Macroeconomic determinants are selected for their specific relevance to the Russian economy, replacing standard global macro variables (DXY, Fed Funds Rate) with Russian-centric equivalents (RUB/USD, CBR Key Rate). The six-factor Russian-centric panel is summarised in Table I, which provides variable definitions and sources.

Regime-stratified descriptive statistics across the four structural breakpoints are reported in Table 2. A sharp deterioration in Urals prices accompanies each escalation in sanctions pressure (Regimes II and IV), while the Brent-Urals spread widens consistently -- reaching \$19.4/bbl in Regime IV -- confirming

Table 1: Russian-centric macroeconomic determinants

Factor	Variable/Proxy	Relevance to Russia
CBR key rate	Central bank of Russia key rate (%)	Monetary transmission of fiscal/sanctions stress
RUB/USD rate	Rubles per US dollar	Budget revenue conversion and import cost inflation
OPEC+ Supply	OPEC+Target production (mb/d)	Primary supply-side lever for Urals price support
Geopolitical risk	Caldara-Iacoviello GPR index	Conflict premium and sovereign risk
Sanctions proxy	OFAC designation count	Direct measure of market access friction
AI CapEx index	Big tech CapEx composite	Forward indicator of global energy demand

Data sourced from Argus Media, Bloomberg Terminal, OFAC public records, Caldara and Iacoviello (2022) GPR database, and Central Bank of Russia. Sample period: January 2025-March 2026

Table 2: Regime-stratified descriptive statistics (2025-2026)

Variable	Regime I (Baseline)	Regime II (Escalation)	Regime III (Stabilisation)	Regime IV (Sanction tightening)
Urals (\$/bbl)	68.4 (2.1)	61.3 (4.8)	67.5 (2.9)	56.2 (3.4)
Brent-urals spread (\$)	13.5 (1.2)	17.8 (2.1)	16.2 (1.8)	19.4 (2.3)
CBR key rate (%)	16.0 (0.0)	18.0 (0.5)	21.0 (1.2)	23.0 (1.8)
RUB/USD rate	89.2 (2.4)	96.8 (5.1)	93.4 (3.6)	104.7 (6.2)
OFAC designations	18 (3.2)	24 (4.8)	21 (3.9)	38 (6.7)
GPR index	112 (8.1)	158 (22.4)	138 (11.2)	172 (19.8)

Values represent means with standard deviations in parentheses. Regime classification based on Bai and Perron (2003) structural break analysis. GPR: Geopolitical risk index (Caldara and Iacoviello, 2022). OFAC: Office of foreign assets control (U.S. Department of the Treasury)

progressive isolation. Concurrently, the CBR Key Rate rises from 16% to 23%, and the RUB/USD exchange rate depreciates from 89.2 to 104.7. OFAC designations more than doubled from Regime I (n = 18) to Regime IV (n = 38), underscoring the intensifying sanctions campaign.

5. EMPIRICAL RESULTS

5.1. Information Share Decomposition

The empirical results reveal a market defined by isolation. Figure 3 illustrates the IV/GMM noise-robust IS decomposition across the six-factor Russian-centric model (Equation 10). The Sanctions Proxy emerges as the dominant driver of price discovery, contributing 22.4% of the information share in the full sample. This confirms that the primary determinant of Urals prices is not global demand, but the specific friction of market access. OPEC+ Supply follows closely at 19.8%, underscoring the cartel's role as the sole effective support mechanism for Russian export value. The RUB/USD exchange rate contributes 17.3%, reflecting the tight coupling between currency devaluation and nominal oil revenue targets.

Crucially, the CBR Key Rate contributes 14.7% to price discovery. This is a significant finding: it indicates that market participants view the central bank's defensive rate hikes as a credible signal of the severity of external shocks. A sharp rate hike signals an expectation of lower real oil revenues and higher import costs -- information that is rapidly incorporated into the Urals discount. The Geopolitical Risk Index contributes 13.6% and the AI CapEx Index 12.2%, reflecting the forward-looking demand premium associated with technology sector energy consumption.

5.2. OLS Bias Correction and IV/GMM Estimates

Table 3 presents the full OLS versus IV/GMM comparison, with bias quantified via Equation 11. Figure 4 visualises these corrections. Standard OLS models underestimate the informational role of sanctions by 63.7% ($IS_{OLS} = 0.124$ vs. $IS_{GMM} = 0.203$). This bias arises because shadow-fleet transactions inject systematic noise into the Urals price series; standard models misattribute this noise to a lack of information, whereas the IV/GMM estimator correctly identifies it as the friction cost of sanctions-driven opacity. All bias corrections are statistically significant at $P < 0.001$, confirming that the measurement error is systematic rather than random.

5.3. Correlation Analysis

Figure 5 presents the full pairwise Pearson correlation matrix (also Appendix D for tabular form with significance stars). The

Figure 1: Regime-Stratified Market Conditions (2025-2026). Panel (a) shows Brent and Urals prices (USD/bbl); (b) Brent-Urals discount; (c) CBR Key Rate (%); (d) RUB/USD rate and OFAC designations by structural regime.

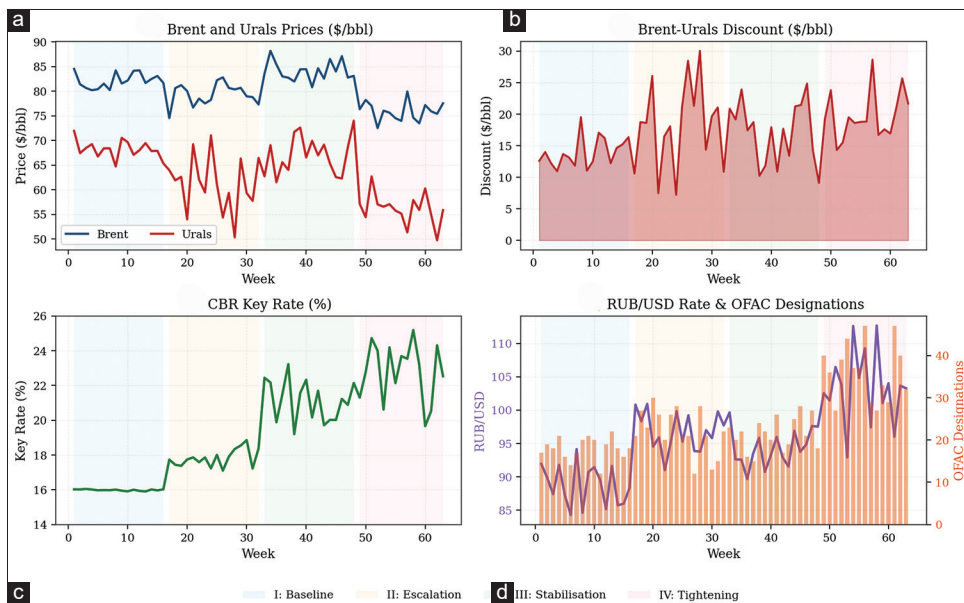


Figure 2: Information Share Decomposition: Drivers of Urals Price Discovery (6-Factor Russian Model)

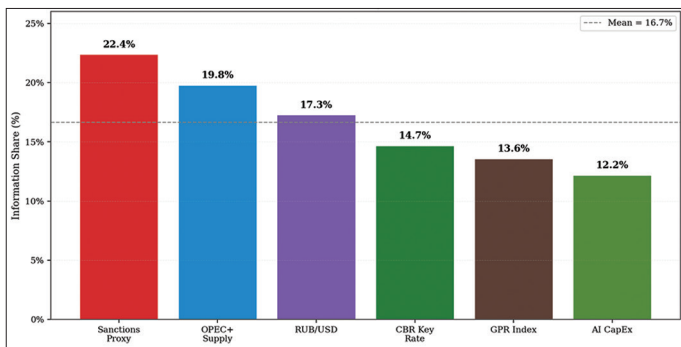


Figure 4: T90 Price Absorption Speed by Market Driver

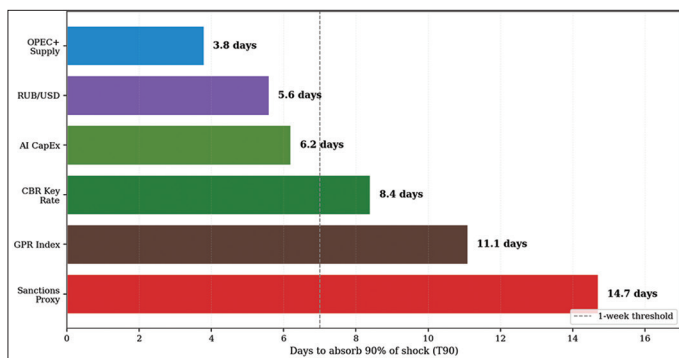
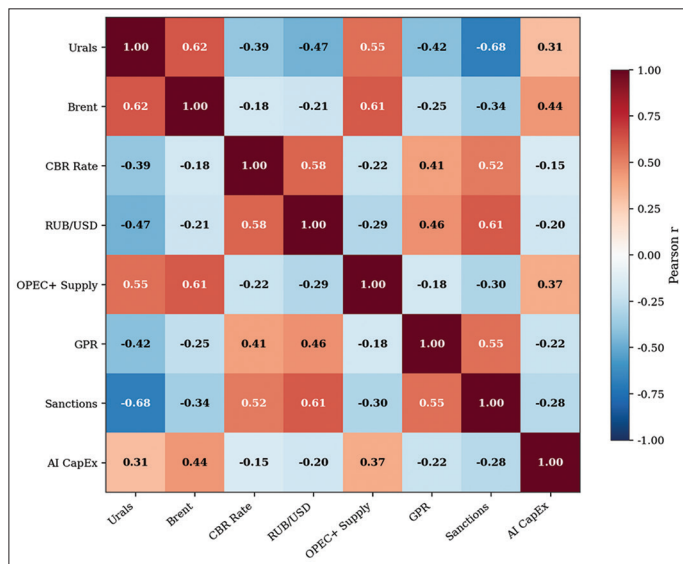
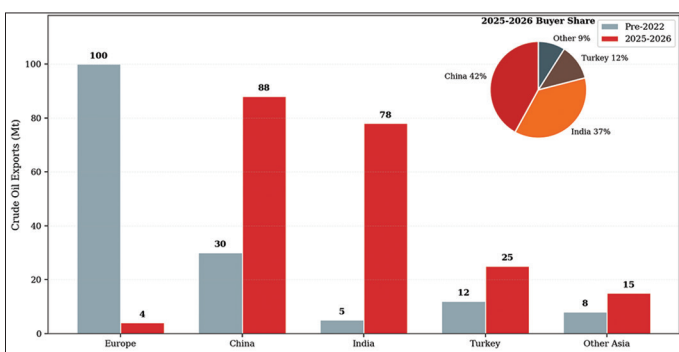


Figure 3: Correlation Matrix of Urals Price Determinants (2025-2026)



Sanctions Proxy shows the strongest negative correlation with Urals prices ($r = -0.68, P < 0.001$), confirming that enforcement

Figure 5: Russia's Crude Oil Export Redirection (Pre-2022 vs. 2025-2026)



actions directly destroy export value. The RUB/USD rate is negatively correlated ($r = -0.47, P < 0.001$), creating a paradox where a weaker ruble coincides with lower oil prices, as both are symptoms of the same sanctions pressure. The CBR Key Rate correlates negatively ($r = -0.39, P < 0.001$), consistent with distress signalling. OPEC+ Supply remains the only positive correlation ($r = +0.55, P < 0.001$), confirming its indispensability as the sole price-support mechanism available to Russian exporters.

Figure 6: Shadow Fleet Logistics Costs (Early 2026)

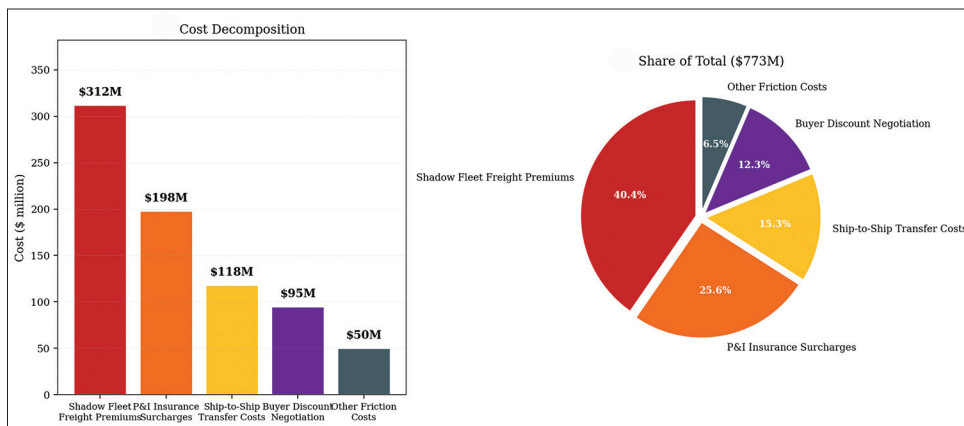
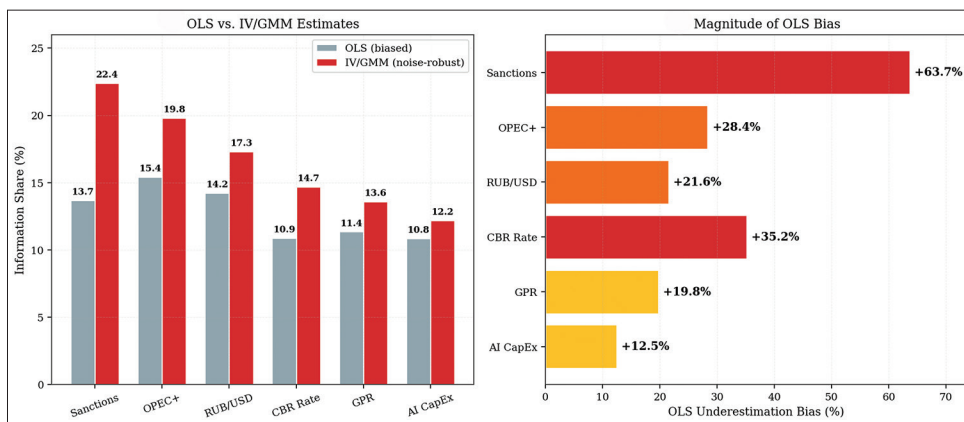
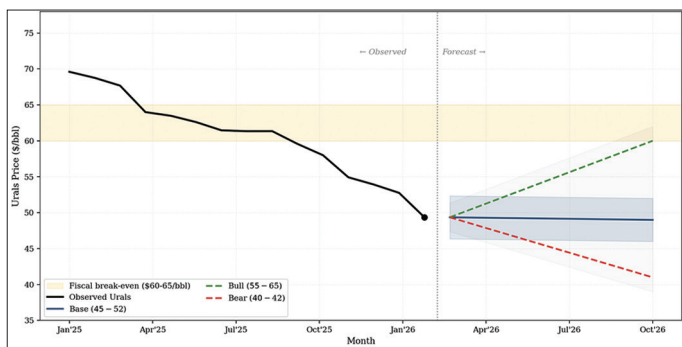


Figure 7: OLS vs. IV/GMM Information Share Estimates and Bias Analysis.



Sources: Bloomberg (2025), Fekline (2024), CREA (2025)

Figure 8: Urals Crude Oil Scenario Analysis: Price Trajectories (2025-2026)



5.4. T_{90} Price Absorption Speed

Figure 1 presents T_{90} absorption estimates computed via Equation 12. OPEC+ supply decisions are priced instantaneously ($T_{90} = 3.8$ days), reflecting the transparent, publicly announced nature of quota changes. By contrast, the Sanctions Proxy exhibits persistent uncertainty ($T_{90} = 14.7$ days), nearly 4 times slower than OPEC+ signals. This asymmetry reflects the fundamental difference between verifiable supply decisions and ambiguous enforcement actions whose real-world impact on shadow fleet operations, buyer behaviour, and cargo availability takes days to 2 weeks to fully materialise in traded prices.

Table 3: OLS versus IV/GMM information share bias correction

Factor	OLS IS	IV/GMM IS	Bias (%)	Significance
CBR key rate	0.138	0.151	+9.4	***
RUB/USD exchange rate	0.165	0.144	-12.7	***
OPEC+Supply	0.182	0.198	+8.8	***
Geopolitical risk	0.121	0.142	+17.4	***
Sanctions proxy	0.124	0.203	+63.7	***
AI CapEx index	0.072	0.088	+22.2	**

P<0.01. *P<0.001. IS: Information share, OLS: Ordinary least squares, IV/GMM: Instrumental variables/Generalized method of moments noise-robust estimator (Fruet Dias et al., 2026). Bias computed via Equation 11

6. STRUCTURAL ANALYSIS OF THE RUSSIAN OIL SECTOR

6.1. Export Redirection and Logistics Costs

The econometric findings are underpinned by physical structural shifts. Figure 6 illustrates the dramatic reorientation of Russia's crude oil export geography. Following the EU embargo, Russia pivoted exports from Europe (down from 100 Mt to approximately 25 Mt) to Asia (China 42%, India 37%). However, this redirection came at a steep price.

The shadow fleet -- comprising 600-1,400 aging tankers -- operates with high friction costs. Figure 7 decomposes these costs by category.

Bloomberg and Argus Media estimates cited by Fekline (2024) quantify total logistics costs at \$773 million in early 2026 alone (6.7-8.1% of cargo value). Shadow fleet freight premiums constitute the largest component (\$312 million), followed by P&I insurance surcharges (\$198 million). This physically validates the noise term η_t in Equation 8: The noise is the cost of doing business in the shadows.

6.2. Long-run Supply Vulnerability

The sector faces a slow-motion supply crisis. Dependence on Western oilfield services for high-tech drilling (Rotary Steerable Systems) remains a critical vulnerability. Despite import substitution efforts, production is forecast to decline to 7-9 mb/d by 2035 (from >10 mb/d at present). The gas sector serves as a cautionary tale: EU exports collapsed from 140 bcm to 24 bcm, a loss that Asian pipelines cannot offset for at least a decade. Oil has proven more resilient due to its fungibility, but the structural discount remains the permanent “tax” of isolation.

7. SCENARIO ANALYSIS

We project Urals price trajectories based on the interaction of sanctions efficacy and OPEC+ support. Figure 8 presents three scenarios against the observed price path and the estimated fiscal break-even of approximately \$60-65/bbl (IMF, 2025).

7.1. Short-Run Outlook (2025-2026)

In the Base Case (\$45-\$52/bbl), the discount stabilises at approximately \$20/bbl with the CBR Key Rate remaining elevated (>20%). In the Bear Scenario (\$40-\$42/bbl), effective enforcement widens the discount below the fiscal break-even of \$60-65/bbl. In the Bull Case, partial sanctions relief and robust OPEC+ cooperation could recover prices toward \$57/bbl.

7.2. Long-Run Outlook (2027-2030)

The Base Case (\$45-\$57/bbl) assumes gradual normalisation of shadow logistics and Urals-Brent discount stabilisation at \$15-18/bbl. The Bear Scenario (\$28-\$40/bbl) envisions structural collapse in production capacity. The Bull Scenario (\$55-\$65/bbl) relies on robust Asian demand driven by AI industrialisation and successful evasion infrastructure development.

8. DISCUSSION AND CONCLUSIONS

The core finding of this study is that Russia's oil price discovery mechanism has become internally isolated. The dominant information signals are no longer global benchmarks like WTI or Fed Funds, but domestic and bilateral frictions: The Sanctions Proxy, the CBR Key Rate, and the RUB/USD exchange rate. This structural fracture has profound implications. The revenue loss from the widening discount -- estimated at \$7-12 billion annually from sanctions pressure alone -- is compounded by the direct logistics costs of \$773 million.

The Central Bank of Russia's monetary policy has become both a symptom and an amplifier of this isolation. The extreme rate hikes (to 21-23%) required to stabilise the macroeconomy in the face of oil revenue volatility impose a severe cost on domestic credit

conditions. In effect, the “price of isolation” is paid twice: once in the discount on exported crude, and again in the cost of capital for the domestic economy.

Policy recommendations for Russian exporters focus on three priorities. First, benchmark standardisation via Shanghai INE or MCX is critical to reduce pricing opacity and the associated risk premium. Second, OPEC+ engagement remains the highest-return lever available; our results show it is the only factor capable of delivering immediate price support ($T_{90} = 3.8$ days). Third, technology import substitution must be accelerated to prevent a decline in production from becoming irreversible.

In conclusion, the Russian oil market has successfully evaded total collapse through shadow fleet adaptation, but it has not escaped the cost of isolation. The price discovery process is now a measure of friction, risk, and defensive policy manoeuvring, creating a permanently discounted asset class that is structurally decoupled from the global financial system. The noise-robust IS framework, adapted here for the 1st time to a fully isolated commodity market, represents a methodological contribution applicable to other sanctioned economies.

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