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Asymmetric Denial

The Cost-Exchange Structure of the Blockade Phase of the 2026 Iran War, and How It Is Made and Kept Favorable to the United States

Evidence through 19 September 2026: who bears the costs of maritime and financial denial, how denial disarms, and the measures that decide whether the exchange favors the United States against Iran, China, and Russia

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Abstract. This paper assesses the blockade phase of the 2026 Iran war as a cost-imposing strategy and sets out what makes it, and keeps it, favorable to the United States. Evidence runs through 19 September 2026, and results are stated as conditions so that they hold when the inputs change. The dollar exchange is favorable while the U.S. cost of denial stays below the blockade-attributable Iranian loss, about \$55 billion a year or \$4.6 billion a month. The Congressional Budget Office rate of \$2-3 billion a month is below that line; the Pentagon's observed rate of about \$4.8 billion is at or slightly above it. The relative-burden ratio equals the dollar ratio multiplied by the ratio of the two economies, about 90 to 108 depending on the year of Iranian GDP used, and is reported as a derived figure. The durable asymmetry is in endurance: Iran likely exhausts accessible foreign exchange within about a year of continuous blockade, while the United States faces no fiscal limit. Denial disarms by starving military industry of revenue and imported inputs, as it did in Iraq from 1991 to 2003, and does not by itself change governments. Against China the effect is structural and modest. Russia gains while prices stay high. U.S. partners bear most of the price shock, and if the contest of the Strait of Hormuz is counted as a cost of the blockade the coalition-level exchange is unfavorable. Six measures convert those entries: separating the strait from the blockade, partner cost-sharing, price and sanctions pressure on Russia, closing outside financing to Iran, protecting interceptor stocks, and a defined settlement. The paper gives a conditional escalation framework, an endurance comparison, and six dated predictions.

Keywords: blockade; economic sanctions; cost-imposing strategy; Strait of Hormuz; Iran; China; Russia; energy security; munitions industrial base; burden sharing. **JEL:** F51, F52, H56, Q43.

This paper was prepared in the author's personal capacity and is not official U.S. government analysis. Earlier drafts received two rounds of source-verification review and one external critique. Source verification was carried out with a language model (Anthropic's Claude). The external critique was by a human reviewer, who checked the paper for sourcing and accuracy. The model

did not draft the paper; all analysis and writing are the author's. The model was also used for production checks (formatting, the PDF build, and the replication harness). None of these reviews was a formal peer review. License: CC BY-NC-ND 4.0. An inputs file and a replication script that reproduces Table 2a, Table 2b, Annex A, and Annex C are distributed with this paper.

Key judgments

- **In its effects this is not a regional war.** Costs reach at least seven sets of actors through eight identifiable channels (Box 1). The adversary network is affected unevenly: Iran severely; China moderately, with the lasting part being the loss of sanctioned supply; Venezuela and Cuba under separate U.S. actions whose stated purpose is to exclude outside powers from the hemisphere; and Russia as a net beneficiary for as long as prices stay high.
- **Against Iran the position is favorable now, and the reason is endurance, not the dollar ratio.** The blockade removes about \$55 billion a year of hydrocarbon exports at a U.S. cost of \$24-57 billion, a dollar exchange of about 0.96:1 to 2.29:1. It is favorable while U.S. cost stays below \$4.6 billion a month. What separates the two sides is that the United States can carry 0.07 to 0.18 percent of GDP without limit, while Iran likely exhausts accessible foreign exchange within about a year.
- **The relative-burden ratio is a derived figure.** It equals the dollar ratio multiplied by the ratio of U.S. to Iranian GDP, about 90 on the IMF's pre-war figure and 108 on its wartime figure. Any dollar-parity exchange between these two states yields a ratio in that range. It describes relative size and tolerance. It is not evidence of efficiency, and the paper does not rest on it.
- **Denial disarms; it does not transform.** The mechanism is physical: no export revenue, no payment channels, and no imported machine tools, components, or propellant precursors. The closest precedent is Iraq from 1991 to 2003, where sanctions, inspections, and limited strikes ended the weapons programs without changing the government. The strategy should be judged by Iranian rearmament and proxy finance, not by regime change.
- **The blockade cannot be costed in isolation.** It was made possible by a campaign that struck 13,000 targets and consumed most of the munitions now being replaced, and Iran's response to it is to contest the Strait of Hormuz. If that contest is counted as a cost of the blockade, the coalition-level dollar exchange falls below parity once more than about 4 percent of the estimated world output loss is attributed to it. Most of that loss falls on U.S. partners.
- **Against China the gain is structural and modest, and it depreciates.** China lost about 1.5 million barrels a day of sanctioned supply from Iran and Venezuela, drew down reserves built in 2025, and observed a working distant blockade. Its cash import bill was roughly unchanged as of the cutoff. China is reducing the oil intensity of its transport sector, so the interdiction lever loses value each year. Through about 2029 the war also worsens the U.S. position in one respect: interceptor stocks.

- **Russia gains under present conditions.** It sells into the price shock, has taken market share in China, and supplies Iran. That entry reverses only if prices fall and enforcement on Russian crude tightens.
- **Six measures decide whether the position is favorable beyond Iran.** Separate the strait from the blockade so that prices fall while Iranian exports stay at zero; have the partners who benefit from escorted transit share its cost, as in 1991; press Russia through price and enforcement; close outside financing to Iran; hold intensity at baseline denial with conditional re-strike and shift drone defense to low-cost effectors so that interceptor stocks rebuild; and define the settlement that ends the blockade.
- **Escalation above conditional re-strike raises U.S. cost faster than Iranian cost.** A renewed large-scale campaign would not be lost militarily, but it would spend the interceptors and standoff munitions the replenishment plan depends on. Seizing Kharg Island adds exposure without adding denial while the blockade holds. Invasion and occupation are excluded.

PART I

Framework: the question, the measures, and the mechanism. Written without dated figures so that it holds as inputs change.

1. The question

Public argument about the war has been conducted mostly in terms of fuel prices, casualties, and whether Iran's government will fall. Nearly all of it treats the conflict as regional: the United States and Israel on one side, Iran and its proxies on the other, with the Gulf states as the terrain. That framing omits most of the ledger.

This paper asks a question in three parts.

- **Who is affected, and through what channel?** The war transmits costs and gains well beyond the belligerents: to states that bought Iranian oil or Iranian weapons, to states that relied on the same patrons, to every energy importer, and to energy exporters.
- **What is each party's cost?** Stated in dollars where the record allows, as a share of that party's economy, and in the non-dollar terms that a dollar ledger hides.
- **What does the United States pay, and what does it receive?** Specifically, once the opening air campaign ended, what does it cost each year to hold Iran under maritime and financial denial, is that exchange favorable when every affected party is counted, and if it is not, what would make it so?

The distribution matters for three reasons.

- **Iran was a node in a wider network.** Before the war it loaded about 2.1 million barrels of crude a day, most of it bound for China [46]. From 2022 it supplied

Shahed attack drones and the production license that Russia used to build its own line; by March 2026 the flow had reversed, with Russia sending upgraded drones, components, and satellite imagery to Iran [70, 71]. It financed and armed proxies from Lebanon to Yemen, as documented annually in the U.S. Department of State's Country Reports on Terrorism. Removing or isolating a node imposes costs on everything connected to it. A bilateral analysis counts none of that.

- **The war is one of a sequence.** The capture of Venezuela's president in January, the fuel blockade of Cuba, and the isolation of Iran have each removed or weakened a state aligned with Beijing and Moscow within a year, and in each case neither patron intervened [39, 37]. The declared purpose of the hemispheric actions is on the record in the 2025 National Security Strategy; a plan to sequence them ahead of Iran is not, and none is assumed here (Section 12). Whether the sequence amounts to a strategic gain for the United States depends on what it cost the patrons, which has to be measured, not asserted.
- **The same channels reach U.S. partners.** The energy price shock that costs China also costs Japan, South Korea, India, and Europe. An assessment that counts adversary losses and omits partner losses is advocacy. One that counts both can say whether the net effect favors the U.S. coalition, and under what conditions.

Box 1. Transmission channels and who bears them

Channel	Mechanism	Bears cost	Gains
1. Direct destruction	Strikes on military, nuclear, and command targets	Iran	U.S., Israel, Gulf states (threat reduction)
2. Export and import denial	Naval blockade; financial sanctions	Iran	None directly
3. Energy price shock	Closure and contest of Hormuz; Houthi strikes on Saudi infrastructure	All importers: China, Japan, South Korea, India, EU; U.S. consumers	Exporters able to ship: U.S. producers, Russia
4. Supply displacement	Loss of sanctioned, discounted barrels from Iran and Venezuela	China	Market-price suppliers
5. Arms-transfer interruption	Iranian drone and missile industry struck and cut off from inputs. Russia no longer depends on Iranian supply and in 2026 is the supplier	Iran; proxies. Russia only marginally	Gulf states; Israel
6. Patron credibility	Non-intervention by Beijing and Moscow as clients fall	China, Russia	U.S. alliance system
7. Market-share transfer	Buyers shift to non-Hormuz crude, products, and LNG	Gulf producers (volume); Qatar (LNG)	U.S. exporters

Channel	Mechanism	Bears cost	Gains
8. Industrial mobilization	Wartime demand funds multi-year munitions expansion	U.S. taxpayer (near term)	U.S. and allied forces after about 2029

Channels 1 and 2 are the regional war that most commentary describes. Channels 3 through 8 are the global one, and they determine whether the strategic argument holds. The sections that follow put numbers on each where the public record allows.

The claim examined is that the second phase of the war is a favorable cost-imposing position: the United States spends a small and bounded amount to deny Iran export revenue, reconstruction, and rearmament, while states aligned with Iran absorb secondary costs. Part II tests that claim against the public record as of 19 September 2026. It finds the claim holds for Iran, holds in part for China, holds for Venezuela and Cuba only as the result of separate U.S. actions, and does not hold for Russia or for the U.S.-led coalition once partner costs are counted. Part III sets out the measures that would make it hold more widely, and the conditions under which it fails.

Three things are not claimed. First, the paper does not claim the effects were obtained without the use of force. The blockade rests on a 38-day campaign of roughly 10,000 sorties [33], and most of the reported U.S. cost is munitions replacement [1]. Second, it does not claim that denial will produce a change of government in Tehran. Third, it does not claim that the war has shifted the core military balance between the United States and China. Each of these stronger claims was considered and is rejected in Section 8.

2. Framework: measures, identities, and attribution

The analysis draws on the competitive-strategies tradition, which asks a state to steer a long contest toward areas where its marginal cost of competing is low and the rival's is high [117, 118]. It also uses Schelling's distinction between brute force, which takes an objective directly, and coercion, which hurts an adversary until the adversary chooses to concede [114]. A blockade does both. It directly removes export revenue and imported inputs, which is brute force against Iran's capacity to rearm. It also aims to change Iranian decisions, which is coercion and is subject to the poor historical record of sanctions as an instrument of political change [115, 116, 120]. The financial component relies on U.S. control of payment and insurance networks, the mechanism Farrell and Newman describe as weaponized interdependence [119].

2.1 Measures, stated as conditions

Results in this paper are written as conditions on inputs, so that a reader with later data can substitute new values and the statement still holds. Dated values are confined to Part II and to the inputs file distributed with the paper.

- **Cost-exchange ratio (CER).** Annual cost imposed on the target by an instrument, divided by the annual cost of that instrument to the imposing state, in dollars. The exchange is favorable when CER exceeds 1, that is, when the imposer's cost is below the attributable loss. The break-even cost is the attributable loss itself.
- **Relative-burden ratio (RBR).** The target's cost as a share of its GDP divided by the imposer's cost as a share of its GDP. Algebraically $RBR = CER \times (\text{imposer GDP} / \text{target GDP})$. It therefore carries no information beyond the CER and the relative size of the two economies. It is reported because tolerance depends on what a cost displaces, but it always makes the smaller economy look more burdened, and it is not a measure of efficiency.
- **Endurance.** The time each side can continue before a named function fails: for the target, foreign-exchange cover, subsistence imports, and military-industrial inputs; for the imposer, fiscal capacity, munitions, energy, domestic politics, and allied tolerance. The claim of asymmetry in this paper rests on the endurance comparison in Section 11, not on the RBR.

Both ratios are computed for the denial phase only. Phase 1 costs are reported but treated as sunk, since the policy question at the cutoff was whether to sustain, escalate, or settle. Neither ratio captures non-dollar costs. Those are handled in Section 8, and they are where the strongest objections lie.

2.2 Two ledgers

A ratio is meaningful only if both sides are measured on the same basis. Two bases are used. The **fiscal ledger** sets U.S. budgetary outlay against the revenue the Iranian state loses. The **economy-wide ledger** sets output and price effects on each economy against one another, which on the U.S. side includes the effect of higher oil prices on consumers, net of the gain to domestic producers, and the inflation CBO attributes to the war. Setting a U.S. fiscal cost against an Iranian economy-wide loss mixes the two and flatters the imposer. Where the public record supports only a mixed comparison, the paper says so and states the direction of the bias.

2.3 Attribution, in two cases

A cost counts toward a ratio only if it is caused by the instrument whose cost is in the denominator. That rule is applied to the numerator and to the denominator. It has one unavoidable ambiguity. Iran's response to the blockade of its ports is to contest transit through the Strait of Hormuz for everyone else. If that contest is treated as independent of the blockade (the **separable case**), the price shock belongs to neither side of the blockade ratio: it is not a cost the blockade imposes on China, and it is not a cost the blockade imposes on U.S. partners. If it is treated as Iran's response to the blockade (the **coupled case**), the continuing part of the price shock is a cost of the denial strategy, and it falls on China, on U.S. partners, and on U.S. consumers alike. Both cases are reported

in Section 7. Section 9 treats the separation of the two in practice as the first policy measure.

2.4 The counterfactual

The alternative to a blockade is not the absence of denial. It is sanctions enforcement without force. Under the first maximum-pressure campaign Iranian crude and condensate exports fell from more than 2.5 million barrels a day in 2017 to an average below 0.4 million in 2020 at negligible U.S. fiscal cost [88]. By September 2024 they had recovered to about 1.8 million [89], and in February 2026 Iran was loading about 2.1 million [46]. The blockade's contribution should therefore be stated against two baselines: the observed pre-war state, in which sanctions were in force and widely evaded, and an enforced-sanctions state like 2020. Section 5 gives both.

3. How denial disarms

The claim that economic denial disarms is a claim about a causal chain, and each link can be observed. Export revenue pays for imports. A military industry of Iran's kind depends on imported machine tools, electronic components, and propellant precursors, and on hard currency to buy them through intermediaries. A blockade and financial isolation cut three links at once: the revenue, the payment channel, and the physical route. Whatever production capacity survived the air campaign then runs down its stock of imported inputs and cannot replace destroyed plant at scale. Limited strikes against identified reconstitution raise the cost of each attempt to rebuild (Section 10). None of this depends on any decision in Tehran, which is why it is the brute-force element of the strategy and the part that can be held to account.

The Iraq precedent. From 1991 to 2003 Iraq was held under sanctions, inspections, no-fly zones, maritime interception, and occasional strikes, including Operation Desert Fox in December 1998. The Iraq Survey Group's final report found that Iraq's weapons-of-mass-destruction capability was essentially destroyed in 1991, that the nuclear program was ended after the Gulf War and not reconstituted, and that no stockpiles existed in 2003 [96, 97]. Its author testified that sanctions both constrained weapons-related imports and led Saddam Hussein to avoid weapons work that would jeopardize his overriding aim of getting sanctions lifted [97]. Containment disarmed Iraq. It did not change the government, which fell only to invasion.

The same record sets out the limits. First, enforcement eroded: by 2000-2001 Iraq was designing missiles around components obtainable only outside sanctions, in its author's testimony [98]. Denial works for as long as it is enforced and no longer. Second, the target's ambition survived; the report found intent to reconstitute once sanctions ended [96]. Disarmament by denial is a condition that has to be maintained or converted into a verified settlement, not an end state. Third, it was not free. One academic estimate put the annual U.S. cost of containing Iraq at about \$19 billion, in an essay circulated in 2003

and later published as a working paper [99], and the humanitarian cost of the sanctions decade weakened international support for them. The instrument applied to Iran is the same one, and Section 6.3 records what it has done to Cuba.

Box 2. Indicators of disarmament by denial

Link in the chain	Observable indicator	Reading that the strategy is working
Export revenue	Tanker-tracked cargoes clearing the blockade zone; oil held at sea; payments received	Exports near zero; stock at sea exhausted; payments cease
Foreign exchange	Open-market rial rate against ambient inflation; central bank transfers for essential imports	Depreciation well beyond inflation; essential-import financing rationed
Imported inputs	Interdictions and designations involving machine tools, electronics, and propellant precursors; overland and Caspian volumes	Seizures continue; overland routes replace only a small share of Gulf throughput
Production	Rate of missile and one-way attack drone launches; reporting on plant reconstruction	Launch rates decline over quarters, not days; reconstruction limited to small workshops
Transfers	Weapons and funds reaching proxies, as recorded in interdictions and in State Department and UN panel reporting	Transfers fall below pre-war scale
Outside supply	Russian or Chinese deliveries of drones, components, imagery, or financing	Supply remains small relative to pre-war Iranian production

The indicators distinguish disarmament from impoverishment. An economy can contract sharply while its missile program continues on a protected budget, as North Korea's has. The test of this strategy is the production and transfer rows, and the public record on them is thin (Section 8, L8).

PART II

Assessment as of 19 September 2026. Every figure in this part is dated; the inputs file lists each value with its date, source, and tier.

4. Phase structure and U.S. costs

Phase 1, 28 February to 8 April. U.S. and Israeli forces opened with nearly 900 strikes in twelve hours, killing Supreme Leader Ali Khamenei and other senior officials [35]. Over 38 days the United States reported striking more than 13,000 targets [33]. The Pentagon told Congress the first six days alone cost \$11.3 billion [4]. A two-week truce was announced on 8 April [32].

Phase 2, 13 April to the data cutoff. After the Islamabad talks failed, the United States imposed a naval blockade on Iranian ports on 13 April. It was lifted on 18 June with a memorandum of understanding and reinstated on 14 July when that arrangement broke down [25, 18]. CENTCOM reports 121 vessels redirected during the first blockade as of 1 June [79] and 105 as of 18 September, two period-specific counts that are not additive (a cumulative count cannot fall), more than 2,000 escorted commercial transits, over one billion barrels of partner crude moved out of the Gulf, mine clearance of the primary lanes completed in late August, and, by its account, no Iranian seaborne exports [24, 22]. The blockade runs alongside a Treasury-led campaign against Iranian financial channels and smuggling networks. Fighting continued: in early September the two sides exchanged strikes on tankers and Iran fired a ballistic missile toward U.S. warships [23].

Table 1. Reported U.S. cost series

As of	Cumulative	Composition and source
First six days	\$11.3B	Pentagon closed-door briefing, as reported [4]
Through 30 June	\$33.4B	\$7.4B operations; \$22.3B munitions replacement; \$3.7B equipment losses [3]
July	\$37.5B	Pentagon estimate cited by CNN [2]
1 August	About \$38B	CBO estimate: \$21.7B munitions replacement (of which \$13.1B interceptors, \$7.3B land-attack cruise missiles), \$10.4B flying hours, \$2.7B fuel, \$1.9B equipment, \$1.5B other; \$2-3B per additional month, more during escalation. CBO states DoD did not supply the data requested and that the estimate carries considerable uncertainty [76, 77]
3 September	\$43.6B	\$11.2B obligated operating costs; \$32.4B unfunded replacement of munitions and damaged assets [1]
3 September, with fuel	\$45.1B	Adds \$1.5B fuel. Excludes base repair and indirect costs [2, 5]

Note: the Pentagon and CBO series use different methods and should not be differenced against each other.

Two run rates bracket the denial phase. CBO's forward estimate of \$2-3 billion a month gives \$24-36 billion a year and is treated as the central estimate. The Pentagon's own series rose \$10.2 billion in the 65 days from 30 June to 3 September, which annualizes to \$57.3 billion. That window is not a clean measure of denial: it includes two weeks in which the blockade was lifted, its reinstatement on 14 July, and the early-September exchanges, and part of the increase may reflect re-estimation of Phase 1 replacement costs rather than new expenditure. It is used as an upper bound. The range is therefore \$24-57 billion. Against IMF-projected 2026 GDP of \$32.38 trillion [62], that is 0.07 to 0.18 percent. Projecting from 3 September to the war's first anniversary gives a first-year total of roughly \$57-73 billion.

The reported totals omit several items: repair of what the DoD Inspector General describes as hundreds of damaged structures across eight countries, future veterans' costs, and interest. Reported materiel losses include four F-15Es, one F-35A, seven KC-135s, seven helicopters, and more than thirty drones [3].

5. Costs imposed on Iran

Iranian data are poor. Tehran has published no GDP figures since 2024 and an internet blackout limits outside measurement [10]. Three external estimates are available and they are broadly consistent.

- The Foundation for Defense of Democracies' economic center put total damage at about \$144 billion as of mid-May, roughly 40 percent of pre-war GDP, with a plausible range of \$50-300 billion. It attributed about two-thirds to the air campaign and one-third to the blockade, [6, 7]. The Washington Examiner's account of the May model says about half of direct damage was to nuclear, missile, drone, air, naval, and air-defense assets [6]; the June FDD summary excludes military hardware as not yet quantifiable [7], so the split is confirmed in the May account, by direct quotation of the estimate's author, and set aside in the June summary. FDD advocates a hard line on Iran, so the figure is treated here as an upper-middle estimate.
- The Institute for Economics and Peace estimates a GDP contraction of 15 to 25 percent and infrastructure damage of \$80-350 billion [8].
- The IMF's April outlook, prepared before the blockade was reinstated, projected a 6.1 percent contraction and 68.9 percent inflation, with the rial reported near 1.3 million to the dollar (rate not independently confirmed) [10].

The IMF put Iran's pre-war nominal GDP at \$361 billion and projects \$300 billion for 2026 [87]; the FDD figure independently implies a pre-war base near \$360 billion. Applying the IEP contraction range to the pre-war base gives an annual output loss of \$54-90 billion. More than 90 percent of Iran's trade moved through the Strait of Hormuz [10]. Iranian officials and outside analysts put assets frozen abroad above \$100

billion, of which negotiators in June discussed releasing about \$12 billion [7]. A further mechanism deserves attention: if export storage fills, Iran must shut in wells, which risks lasting reservoir damage [6]. That would convert a revenue loss into a permanent capacity loss. The evidence on this is divided. Iran began cutting output in late April, and an official said as much as 30 percent of reservoirs could be affected, while asserting that Iranian engineers have long experience idling and restarting wells [44]. Columbia's Center on Global Energy Policy judged that shut-ins need not cause long-term damage [45].

Pre-war export volumes can now be stated. Tanker tracking put Iranian loadings at about 2.1 million barrels a day in February, falling to about 0.57 million after 13 April and, by one account, to zero in May [46, 7]. Iran Open Data, citing OPEC, puts oil and refined product exports at \$45 billion in 2025, 42 percent of total exports, and adds its own estimate of \$10 billion in LPG [46]. A hydrocarbon export loss of roughly \$55 billion a year is consistent with the \$54-90 billion output-loss range derived above.

On military industry, the Chairman of the Joint Chiefs stated that about 90 percent of Iran's weapons factories, more than 80 percent of missile facilities, and nearly 80 percent of the nuclear industrial base had been struck, including every Shahed production site [31, 32]. These are statements about targets attacked, not verified destruction. A Stimson Center analyst urged skepticism pending battle damage assessment, and CNN reported a U.S. intelligence assessment that Iran retained significant launch capability [31, 34]. The defensible finding is narrower: whatever fraction survived, the blockade and financial isolation deny Iran the imported machine tools, components, and revenue needed to rebuild at scale. That is the brute-force element of denial, and it does not depend on any decision in Tehran.

Three adjustments bound the export numerator. First, it is revenue at reported export values, not what the Iranian state received. Sanctioned crude sells at a discount and through intermediaries who keep a margin, so realized receipts were lower than \$55 billion; the size of the discount is not verified and no figure is used here. Second, the baseline matters (Section 2.4). Against the observed pre-war state, in which sanctions were in force and evaded, the blockade removed about 2.1 million barrels a day. Against an enforced-sanctions state like 2020, when exports averaged below 0.4 million barrels a day [88], the blockade's marginal contribution is the last fifth of the volume, together with the speed and certainty of the cut and the physical denial of imports, which financial sanctions do not enforce. This paper uses the observed baseline because it was the state of the world in February 2026, and because reproducing 2020-level enforcement would have required secondary sanctions on Chinese refiners and banks whose cost is not zero. A reader who judges that enforcement alone could have reproduced the 2020 result should scale the \$55 billion numerator to roughly one-fifth, at which point the dollar exchange is unfavorable at any U.S. cost in the range. Third, the two components of the \$55 billion are not equally sourced. Iran Open Data attributes

the \$45 billion for oil and refined products to OPEC; the \$10 billion for LPG is its own figure and carries no upstream attribution [46]. On oil and refined products alone the break-even falls from \$4.58 billion to \$3.75 billion a month, and the dollar exchange from 0.96:1-2.29:1 to 0.79:1-1.88:1 (at the CBO high rate, from 1.53:1 to 1.25:1). The CBO rate is below the break-even and the Pentagon-series rate is above it on either numerator, so no finding in this paper turns on the LPG figure.

6. Costs falling on China, Cuba, Venezuela, and Russia

6.1 China: what the numbers show

China's crude imports fell to 8.1 million barrels a day in the second quarter, 32 percent below the prior quarter, and below 8.0 million in May and June for the first time since 2016. They had averaged 12.0 million from mid-2025 through February [12]. The Middle East ordinarily supplies about half of China's crude [14, 66]. June imports were 41 percent below a year earlier, and Gulf cargoes that did move were redirected mainly to Japan, South Korea, Thailand, and India [13].

The cost to China depends on the accounting basis, and the three bases give very different answers. The EIA spot price for West Texas Intermediate was \$92.55 on 3 September against \$64.36 a year earlier, an increase of \$28.19 or 44 percent [61]. WTI is a proxy; the delivered price of Chinese imports is closer to a Brent or Dubai basis.

Table 2a. China's crude cost on three bases (annualized; Annex A)

Basis	Calculation	Result	What it measures
Unit cost	\$92.55 / \$64.36	+44%	Price paid per barrel. Unambiguously higher
Gross price effect	8.1 mb/d x \$28.19 x 365	\$83B (0.40% of GDP)	Extra paid on the barrels China did buy, against buying them at last year's price
Cash import bill	8.1 x \$92.55 x 365, less 12.0 x \$64.36 x 365	\$274B less \$282B = -8B	Actual change in outlay. Roughly flat: volume fell 32% as price rose 44%
Deferred refill	up to 2.33 mb/d x \$28.19 x 365	up to \$24B	Extra cost of later replacing drawn stocks at current prices (upper bound)
Replacement-cost total	gross + refill	up to \$107B (0.51% of GDP)	Economic cost if stocks are rebuilt at current prices

The cash bill falls whenever the year-on-year price rise is below 48.1 percent, because pre-war volume was 1.481 times second-quarter volume (12.0 / 8.1). On the WTI basis used here the rise is 43.8 percent and the bill is 3 percent lower. A Brent or Dubai basis

would be closer to the delivered price of Chinese imports and has not been computed here. The result is sensitive to the date chosen: at the mid-September Brent price above \$108 that followed the shutdown of the Saudi East-West pipeline [19], the rise is near 60 percent and the bill would be about 8 percent higher. The defensible statement is that China's cash import bill is roughly unchanged, within plus or minus 10 percent, while volume is down a third. The finding is that China was paying about 44 percent more per barrel and had not, as of the cutoff, paid materially more in total. It has met the shock by buying a third less and drawing on reserves accumulated in 2025, when imports of 11.6 million barrels a day against refinery runs of 14.75 and domestic output of 4.32 implied a stock build of about 1.17 million barrels a day [12, 63]. The cost is therefore a depletion of reserves, which is a cost in security as much as in dollars, plus a refill liability that falls due when Beijing chooses to rebuild.

Attribution. Nearly all of this is caused by Iran's closure of the strait and by Houthi strikes on Saudi infrastructure, not by the U.S. blockade. The blockade's direct effect on China is narrower: the loss of Iranian barrels. That loss is now measurable and has a date. Iranian loadings fell from about 2 million barrels a day in March to 220,000-255,000 in August, and no cargo has crossed the blockade since 14 July. Chinese imports of Iranian crude fell from about 823,000 barrels a day in July to about 534,000 in August. They have been sustained by oil already at sea: about 180 million barrels in late April on one Kpler-based account [46], about 80 million in late August, and about 29 million outside the blockade zone in early September, down from 90 million in mid-July. At roughly 1 million barrels a day of deliveries that stock would be exhausted by mid-October 2026, with payments to Iran largely ending by mid-December [68, 69]. From the fourth quarter of 2026 China loses a supplier of roughly one million barrels a day. Those barrels sold at a discount whose size is not verified, so no dollar value is placed on the loss.

6.2 How long China's reserves last

Annex C sets out a crude balance for China and computes how long inventories cover a supply deficit. Days of cover equal usable inventory divided by the daily deficit, where the deficit is refinery runs, less any rationing, less domestic output, less imports still arriving. Inputs are 2025 refinery runs of 14.75 million barrels a day and domestic output of 4.32 [63], overland pipeline imports of 0.8 (the ESPO spur at 0.6 and the Kazakhstan line at 0.2, both at capacity) [64, 65], and three inventory cases: 1,387, 1,541, and 1,710 million barrels. The first and third apply the International Energy Agency convention that 10 percent of stocks are unavailable to the EIA strategic figure and the Goldman Sachs total [15, 13, 80, 81]. The estimates have error in both directions. Four simplifications shorten them: refinery runs are held at the 2025 level, product stocks are ignored, China's product exports are not redirected to domestic use, and Hormuz exposure is set at the upper end of published measures. Four lengthen them: no limit is placed on the rate at which strategic storage can be drawn, no minimum operating

inventory is held back beyond the 10 percent convention, storage is assumed to be where the refineries that need it are, and crude grades are treated as interchangeable. The results are central estimates under stated inputs, and Table C3 shows how far the usable fraction moves them.

- **At the second-quarter 2026 rate of draw** (imports of 8.1 million barrels a day), reserves last about 20 to 24 months even if refineries ran at 2025 levels, and far longer at observed demand. China is under no near-term physical constraint.
- **If all Hormuz-transiting supply were lost with no replacement** (about 5.4 million barrels a day, China's share of Hormuz crude flows in EIA chokepoint data for early 2025 [82, 83]), cover is about 12 to 15 months; with a 10 percent demand reduction, 19 to 24 months.
- **Under full seaborne interdiction**, a wartime case outside the scope of this conflict, cover is about 5 to 6 months without rationing and 9 to 11 months with 30 percent rationing.
- **Russian overland supply is not the swing factor.** Losing the ESPO spur on top of full interdiction shortens cover by about 6 percent. What determines China's endurance is seaborne access and its willingness to ration, not the pipelines.

A compound scenario, in which Russia loses further export capacity to Ukrainian strikes while Gulf supply is constrained, is cases S4a and S4b. Two facts limit its effect. First, geography: about three-quarters of the Russian seaborne crude unloaded in China is ESPO grade loaded at Pacific ports, and the overland pipelines run through Siberia and Kazakhstan, all far beyond Ukrainian strike range; only the Baltic and Black Sea volumes, about a quarter of the seaborne flow, are exposed [67]. The deepest Ukrainian strike as of the cutoff, on 9 September 2026, reached about 2,840 kilometers, up from about 2,500 in July [85, 86]; the Skovorodino spur lies more than 5,000 kilometers from Ukrainian territory and Kozmino roughly 7,000 (author's great-circle estimates). The western feeder network is a different matter: Omsk, struck in July, sits on it, and demonstrated range grew by over 300 kilometers in two months. Second, the effect of Ukrainian strikes on China's supply is ambiguous. Reduced Russian refining diverts some crude to export, and in July Chinese unloadings of Russian seaborne crude rose 28 percent while Russia's share of China's seaborne imports reached 25 percent [67], but that is one month of data, and strikes on export terminals and pipelines would have the opposite effect. In the model, losing the exposed Russian volumes shortens cover in the Hormuz-loss case from 12-15 months to 11-13; losing all Russian seaborne crude shortens it to 9-11.

Three further points bound the result. China's electricity system runs on coal and renewables, so an oil shortfall falls on transport and petrochemicals, where new-energy vehicles already displace demand: gasoline and diesel use fell 13 and 17 percent year on year as new-energy vehicle exports more than doubled [13]. Consumer prices rose 0.8 percent in August, which ended the deflation of 2025 [41]. And China has lost no forces,

platforms, or munitions. The military feasibility of interdiction is outside this paper's scope and is treated in a companion paper [75].

6.3 Venezuela and Cuba

These are effects of separate U.S. actions in the same period, not of the Iran war, and the paper counts them as context for the patron-credibility channel and not as costs imposed by the blockade of Iran. U.S. forces captured Nicolas Maduro on 3 January. Venezuela had supplied China about 470,000 barrels a day in 2025, some 4.5 percent of its seaborne imports, largely as debt service on loans that GIGA researchers put near \$60 billion [39, 40].

Cuba has been under a U.S. fuel blockade since January, enforced by the threat of tariffs on any supplier [38]. Venezuela and Mexico, its two main suppliers, stopped shipments. More than 90 percent of Cuban electricity is generated from oil. The energy minister said on 13 May that the island had run out of diesel and fuel oil; most of the population has been without power for 20 hours or more a day; the national grid had collapsed five times by mid-July; public transport has largely stopped and tens of thousands of surgeries have been cancelled [72, 73]. The only significant relief was a Russian cargo of about 730,000 barrels that Washington chose to let through on 30 March, enough for nine or ten days of diesel demand [37, 74]. Two observations follow. The instrument is the same one applied to Iran, and its humanitarian cost is visible and large. And the price of keeping a client alive is small: that cargo was worth roughly \$66 million at current prices, which Russia could repeat monthly without strain. The constraint on Moscow was U.S. permission, not money. In each case Beijing and Moscow protested and did not contest the action.

6.4 Russia

Russia is the exception, and the paper's argument has to accommodate it. Russia sells into the price shock. Reuters calculated that receipts from Russia's mineral extraction tax on oil would roughly double between March and April, to about 700 billion roubles (\$9 billion), and the Centre for Research on Energy and Clean Air found Russian fossil fuel export earnings at a two-year high in March [60]. It has also taken market share in China, as noted above. Nor has Russia lost a drone supplier. Iran provided Shahed drones and a production license from 2022, but Russia now builds its own at scale, and in March 2026 U.S. and European officials reported Russia sending upgraded drones, components, and satellite imagery to Iran [70, 71]. Russia is an active supporter of the other side, at low cost to itself.

Russia's losses are real but come from elsewhere. Ukrainian strikes cut its product exports to a record low in July and pipeline crude earnings fell 21 percent [67]. Expansion of U.S. LNG further closes the European gas market [17]. Its share of global arms exports fell from 21 to 6.8 percent between 2016-20 and 2021-25 while the U.S. share rose to 42 percent [36], a result of the war in Ukraine that predates this conflict. Its record as a

patron now includes Syria, Venezuela, and Iran. A claim that the Iran war damages all U.S. adversaries is not supportable. A claim that it damages Iran severely and China moderately, while benefiting Russia for as long as prices stay high, is.

7. Returns to the United States, and the ledger

- **Energy market position.** U.S. petroleum exports reached a record 13.6 million barrels a day in April, with crude at a record 5.6 million and propane above 2.0 million for the first time [16]. LNG terminals are running near maximum utilization; EIA forecasts 17.0 billion cubic feet a day for 2026 against the prior record of 15.1 [17]. Domestic crude output is forecast at a record 13.8 million barrels a day [20]. These gains accrue to private producers, not to the Treasury, and they are partly paid by U.S. partners.
- **Munitions industrial base.** Seven-year framework agreements aim to raise PAC-3 MSE output from about 600 to 2,000 a year by the end of 2030 and THAAD from 96 to 400, with matching agreements for seekers, propulsion, and structural components, a \$58.6 billion PAC-3 multiyear award, and a seven-year THAAD production contract reported at over \$35 billion [26, 27, 29, 30, 28]. The war supplied the demand signal that a decade of warnings had not.
- **Coalition integration.** CENTCOM reports working with all six Gulf Cooperation Council states on air defense and transit [24]. The operational habits formed are an asset that outlasts the war.
- **Proliferation and proxy finance.** Iran armed Russia with Shahed drones from 2022 and has armed proxies across the region [70]. A state without export revenue, access to payment channels, or imported components has less to transfer. This is likely the most durable return, because it holds whether or not the government changes.
- **Partner-network contraction.** Set out in Section 6.

Table 2. Ledger by party (annualized)

Party	Dollar cost	Share of GDP	Principal non-dollar items and attribution	Confidence
United States	\$24-57B military [3, 1]	0.07-0.18%	One-half to two-thirds of interceptors used since June 2025 (CBO), at least five years to replenish; SPR at 285M bbl; casualties; +0.5 pt inflation by early 2027 [3, 19]	Moderate-high
Iran	\$54-90B output loss (author calculation from [8, 7])	15-25%	Caused by the campaign and the blockade. One-time damage \$80-350B; inflation near 69%; risk of lasting reservoir damage; leadership losses	Low-moderate

Party	Dollar cost	Share of GDP	Principal non-dollar items and attribution	Confidence
China	Gross price effect \$83B; cash import bill -8B; refill liability up to \$24B (author estimates, Table 2a)	Gross 0.40%; cash about 0	Caused mainly by the strait closure and Houthi strikes, not by the U.S. blockade. Blockade-attributable: loss of about 1 mb/d of Iranian crude from Q4 2026. Reserve draw up to 2.3 mb/d. Offsets: 1.5-1.9B bbl inventory; NEV export growth; no military loss	Low-moderate
Russia	Net gain: oil tax receipts roughly doubled March to April [60]	Positive	Gains revenue and market share in China. Supplies drones and imagery to Iran. Losses (refined product exports, European gas, arms market share) come from the Ukraine war, not this one	Low
Cuba; Venezuela	Not quantified	Severe for Cuba	Separate U.S. actions. Cuba: fuel imports near zero since January, five national grid collapses. Venezuela: government removed; 470 kb/d to China ended	Moderate
U.S. partners and rest of world	About \$1.3T in PPP terms (IEP Scenario 2, which IEP calls the most likely near-term outcome) [9, 8]; about \$0.75T at market exchange rates (author conversion)	0.6% of world output	Gulf growth cut to 1.3% from 4.5% [11]; fertilizer, helium, and LNG shortages	Low

Attribution for Iran. The \$54-90 billion output loss in Table 2 is caused by the 38-day air campaign as well as by the blockade, so dividing it by the denial-phase cost sets a largely Phase 1 effect against a Phase 2 cost. That is the same error this paper corrects for China. Three numerators are therefore reported. (a) Total war-attributable output loss: CER about 1:1 to 4:1, RBR about 85:1 to 337:1. This overstates the blockade's effect. (b) Lost hydrocarbon exports of about \$55 billion a year: CER about 0.96:1 to 2.29:1, RBR about 86:1 to 206:1. This is the preferred basis, because the causal link is observed: Iranian exports continued near pre-war levels through the air campaign in March and collapsed only after the blockade began on 13 April [44, 46]. It is export revenue, not value added, and it omits blocked imports, so it is imprecise in both directions. (c) FDD's one-third blockade share applied to the output loss, \$18-30 billion: CER about 0.3:1 to 1.3:1, RBR about 28:1 to 112:1. Basis (b) is the one used for the break-even below and throughout Part III. **Direction of bias.** Every known error pushes these ratios the same way. Reported U.S. costs omit base repair, veterans' costs, interest, and the inflation CBO attributes to the war, and the Iranian estimates come from an advocacy-aligned institution and a modeled scenario. The ratios are upper-biased by construction. If true U.S. costs were half again as large as reported, the dollar exchange on basis (b) would fall

to about 0.6:1 while the RBR would remain above 50:1, which shows again that the RBR is carried by relative size. For China no blockade-attributable CER is computed, because the cost China bears is not caused by the instrument being priced. A war-attributable RBR on the gross basis is between about 2.3:1 and 5.4:1; on a cash basis it is close to zero. The last row is the most important caveat in the paper: the same price shock that costs China about 0.4 percent of output on the gross basis costs the world economy, including every U.S. treaty ally that imports energy, a comparable or larger share. The IEP figure is stated in purchasing-power-parity dollars, which is why \$1.3 trillion corresponds to 0.6 percent of world output; at market exchange rates the same share is roughly \$0.75 trillion.

Break-even. On basis (b) the dollar exchange is favorable while the U.S. cost of denial is below \$55 billion a year, which is \$4.58 billion a month. CBO's forward rate of \$2-3 billion a month is 44 to 65 percent of that. The Pentagon series implies \$4.77 billion a month, on which the exchange is 0.96:1, slightly below parity. That series is an upper bound for the reasons given in Section 4: its window includes two weeks without a blockade, the reinstatement, the early-September exchanges, and possible re-estimation of Phase 1 replacement costs. The statement that survives new data is the condition, not the ratio: the position is favorable in dollars for as long as the monthly cost of denial stays under the monthly value of what it removes.

RBR as an identity. The IMF put Iran's nominal GDP at \$361 billion before the war and projects \$300 billion for 2026 [87]. U.S. GDP is 89.7 times the first and 107.9 times the second, so every RBR is the corresponding CER multiplied by a number in that range. The pre-war figure is the right base for a loss stated as a share of pre-war output: on it the export loss is 15.2 percent of GDP and the RBRs are those given above. The wartime figure gives the upper end: 18.3 percent of GDP, and an RBR on basis (b) of up to about 247:1. A dollar-parity exchange gives 90:1 to 108:1, as it would for any instrument that cost the United States what it cost Iran. The ratio is reported because it indicates tolerance. Neither IMF figure is a market-exchange-rate figure; the IMF converts at a rate closer to the official one. At the open-market rial rate Iran's dollar GDP would be far smaller and the RBR far larger. That is not computed here, because the result would be set by the choice of exchange rate and not by the economics.

Like-for-like ledgers. The ratios above set a U.S. fiscal outlay against Iranian export revenue, which is close to a fiscal comparison because hydrocarbon exports accrue largely to the state; the residual bias is that realized receipts were below reported export value. On the economy-wide ledger the U.S. side is larger than the fiscal figure. U.S. petroleum consumption of about 20.6 million barrels a day [93] at the same \$28.19 price rise used for China is a gross price effect of about \$212 billion a year, 0.65 percent of GDP. Most of that is a transfer to U.S. producers, since the United States is a net petroleum exporter, so the national effect is far smaller than the gross figure and may be close to zero; the distributional effect is large and is what drives the domestic political

constraint (L6). CBO's estimate that the war adds about half a percentage point to inflation by early 2027 is the measured macroeconomic cost. The price shock is caused mainly by the contest of the strait, so whether it belongs in the blockade ratio at all is the attribution question below.

Table 2b. The Iran exchange under separable and coupled attribution (annualized)

Share of world loss attributed to the continuing strait contest	Added coalition cost	Coalition cost of denial	CER (Iran numerator \$55B)	Note
0%	\$0B	\$24-57B	0.96:1 to 2.29:1	Separable case
5%	\$38B	\$62-95B	0.58:1 to 0.89:1	
10%	\$75B	\$99-132B	0.42:1 to 0.56:1	
25%	\$188B	\$212-245B	0.22:1 to 0.26:1	

World loss: IEP Scenario 2 at market exchange rates, about \$750 billion (author conversion). The share is not estimated; the table shows sensitivity. Computed from the inputs file.

Reading Table 2b. In the separable case the exchange is as stated above. In the coupled case the coalition-level exchange falls below parity once more than about 4 percent of the estimated world output loss is attributed to the continuing contest of the strait, at the CBO low rate, and is below parity at any share on the Pentagon rate. The coupled case also adds to the adversary side: China's gross price effect of about \$83 billion sits there, and Russia's windfall sits against it. The paper does not net those, because the world figure is a modelled scenario and the shares are unknown. The defensible statement is directional. For the United States alone, against Iran, the exchange is near parity in dollars and strongly favorable in endurance. For the U.S.-led coalition, with the strait contest counted, it is unfavorable in dollars. That is why the first measure in Section 9 is to break the coupling.

8. Limits, counterarguments, and failure modes

L1. Phase 1 cannot be assumed away, in the denominator or the numerator. Much of Iran's output loss was caused by Phase 1, which is why the exchange is computed on the blockade-attributable export loss alone (Section 7). The favorable run rate also exists because a costly campaign preceded it. A state that tried to reproduce the denial phase without first suppressing the target's air defenses, navy, and mine-laying capacity would face a different cost structure. The model describes the marginal cost of sustaining denial, not the cost of achieving it.

L2. The blockade is coupled to the strait. Iran's counter to a blockade of its ports is to contest transit for everyone else. JPMorgan estimated in April that only about 0.8 billion of 8.4 billion barrels in global inventories were usable without operational stress [42].

The U.S. Strategic Petroleum Reserve is at its lowest level since 1982, with releases structured as loans not fully repayable until September 2028 [19, 21]. A long blockade therefore implies a long escort mission and, unless transit is secured, a long period of elevated prices. The two are coupled by Iranian choice and by Iran's remaining means of contesting transit, not by geography. Section 7 reports the exchange under both a separable and a coupled attribution, and Section 9 treats breaking the coupling as the first measure.

L3. Interceptor depletion. CBO reports that between one-half and two-thirds of U.S. missile-defense interceptors may have been used since June 2025 and that replenishment could take at least five years; CSIS estimates fewer than 1,000 Patriot and, by a secondary account of the same estimate, fewer than 250 THAAD interceptors on hand [3, 29]. PAC-3 output is limited by seeker production of roughly 650-700 units in 2025 [30]. These are the same inventories a Western Pacific contingency would draw on. This is the one dimension in which the war improves China's relative position, and the dollar ledger does not show it. Section 9 (M5) addresses it.

L4. Denial impoverishes more reliably than it transforms. Iraq from 1990 to 2003, North Korea, and Cuba each sustained severe economic isolation for a decade or more without a change of government; in Iraq the government fell only to invasion. Pape's finding that sanctions rarely achieve major political objectives has held up [115, 116]. In Iran the system consolidated quickly under hard-liners after Khamenei's death [35]. The strategy is defensible as containment and disarmament. It is not a reliable path to a different government.

L5. The costs fall on partners. Table 2, last row, and Table 2b. A strategy that depends on allied tolerance of elevated energy prices has a political half-life set in allied capitals, not in Washington.

L6. Domestic sustainability. Polling shows rising U.S. opposition to the war, partly over its economic effects, with midterm elections in November [1]. A cost-imposing strategy signals weakness if the target believes the imposer's time horizon is short.

L7. Legitimacy. About 170 people were killed when a missile struck a girls' school in Minab on the first day [35]. Blockade is an act of war under international law. Both bear on coalition cohesion and on the precedent available to other powers.

L8. Data. Official U.S. claims are unaudited. The principal Iranian damage estimate comes from an advocacy-aligned institution. Iranian statistics are unavailable. The China figure is the author's.

PART III

Strategy: what makes the position favorable and keeps it so. Measures, escalation framework, endurance, implications for China and Russia, conditions, and predictions.

9. Making the exchange favorable: six measures

Part II finds a position that is favorable against Iran, roughly neutral to slightly negative against China in the near term, negative against Russia, and costly to U.S. partners. Each unfavorable entry has an identifiable cause, and each cause has a policy response. Nearly all of them run through one variable, the oil price, which is set by the contest of the strait and not by the blockade of Iranian ports. The six measures below are ordered by their effect on the ledger.

M1. Separate the strait from the blockade

The blockade of Iranian ports and the security of transit for everyone else are coupled by Iranian choice, not by geography. The coupling weakens as Iran's means of contesting transit are removed and as export routes that avoid the strait expand. By the cutoff CENTCOM reported mine clearance of the primary lanes and more than 2,000 escorted transits [24, 22]. Before the war EIA estimated that about 2.6 million barrels a day of unused Saudi and Emirati pipeline capacity could bypass the strait; the Saudi East-West line is rated at 5 million barrels a day and was run at 7 million during the war, and the Emirati line to Fujairah carries up to 1.8 million [90, 91]. Abu Dhabi has ordered the acceleration of a second line that would double export capacity through Fujairah in 2027 [92]. The aim is a state in which Iranian exports are at zero and partner exports move at volume, so that prices fall while denial continues. That single change reduces partner costs, removes Russia's windfall, lowers U.S. inflation, and leaves China's loss of sanctioned supply in place. The risk is that bypass infrastructure is itself a target: the shutdown of the East-West line in mid-September sent Brent above \$108 [19]. Defense of that infrastructure is part of the denial mission, not an addition to it.

M2. Partner cost-sharing

The states that benefit most from escorted transit are the Gulf exporters and the Asian importers. In 1991 allied governments pledged about \$54 billion against a Pentagon cost estimate of \$61 billion for the Gulf War, and had paid about \$50.5 billion by November of that year; the largest contributors were Saudi Arabia, Kuwait, the United Arab Emirates, Japan, Germany, and South Korea [94, 95]. Burden sharing is stated U.S. policy in the 2025 National Security Strategy [102]. If partners carried a share s of the cost of denial, the U.S. fiscal exchange becomes \$55 billion divided by $(1 - s)$ times U.S. cost: at one-half, about 1.9:1 to 4.6:1; at the 1991 share of 89 percent, about 8:1 to 20:1. The precedent is imperfect. In 1991 there was a Security Council mandate and a liberated state with the means and the motive to pay. In 2026 the same partners already bear the price shock and may regard a contribution as paying twice. Cost-sharing is therefore more plausible after M1 has lowered prices than before.

M3. Russia: price first, then enforcement

Russia's gain is a price effect. Its oil tax receipts roughly doubled between March and April [60], and it has taken share in China [67]. The entry reverses through the same channel. Lower prices under M1 remove the windfall. Enforcement against buyers and carriers of Russian crude then reduces volume or widens the discount, and long-term U.S. LNG contracts make the loss of the European gas market permanent [17]. The order matters: tightening enforcement on Russian barrels while the strait is contested would raise prices further and add to partner costs. Whether Washington chooses to press Russia at all is a policy decision outside this paper. Until it does, the accurate statement is that Russia is a net beneficiary of the war.

M4. Close outside financing to Iran

Section 11 estimates that essential Iranian imports cost on the order of \$15 billion a year, a sum either patron could provide overland without strain. That would not restore export revenue or military industry, but it would extend the subsistence horizon indefinitely and with it Tehran's ability to wait. The response is secondary sanctions on the specific banks, exchange houses, and overland logistics firms that carry such financing, and interdiction of military inputs on the Caspian and overland routes. The measure has a cost with Beijing, and that cost rises with the number of Chinese institutions designated. Its purpose is narrow: to keep outside support at the level of subsistence and below the level of rearmament.

M5. Protect interceptor stocks

The one respect in which the war worsens the U.S. position against China is the depletion of missile-defense interceptors (L3). Two things close that gap. The first is posture: hold intensity at baseline denial with conditional re-strike (Section 10), because every higher rung consumes the inventories the production plan is rebuilding. The second is the tactical cost exchange in drone defense. The Air Force chief of staff put the guided 70 mm rocket used against one-way attack drones at about \$35,000 a round against about \$1 million for a medium-range air-to-air missile [103]. Moving drone defense to effectors of that class reserves Patriot and THAAD rounds for the ballistic missiles that only they can engage. Low-cost effectors do not address the ballistic threat, so this measure slows depletion and does not end it; the production increases in Section 7 do that, from about 2029.

M6. Define the settlement

Endurance without an endpoint invites the target to wait for the imposer's politics to change. The Iraq record shows both halves of the problem: the prospect of sanctions relief was the strongest influence on the government's weapons decisions, and over a decade without a settlement enforcement eroded [97, 98]. A defined settlement states the verifiable disarmament terms that end the blockade, sequences relief against

verification, and uses the assets frozen abroad, put above \$100 billion with about \$12 billion discussed for release in June [7], as the instrument of sequenced relief. The risk is that relief funds rearmament. David Kay, who led the Iraq Survey Group before Duelfer, judged that monitoring would have detected a large-scale restart of prohibited programs though not small-scale cheating [97]; a settlement should be designed to the same standard.

Table 7. Measures and the ledger entries they change

Measure	Entry changed	Direction	Principal risk
M1 Separate strait from blockade	Partner and world price shock; Russian windfall; U.S. inflation; SPR exposure	Coalition exchange moves from the coupled toward the separable case (Table 2b)	Bypass and export infrastructure is targeted
M2 Partner cost-sharing	U.S. fiscal cost	Fiscal CER rises in proportion to $1 / (1 - s)$	Partners already paying through prices; no mandate comparable to 1991
M3 Russia: price, then enforcement	Russian revenue and market share	Net gain becomes net loss	Enforcement before M1 raises prices; policy choice not yet made
M4 Close outside financing	Iranian subsistence horizon	Keeps outside support below the level of rearmament	Cost with Beijing rises with each designation
M5 Protect interceptor stocks	U.S. position against China through about 2029	Depletion slows; production overtakes consumption	Ballistic threat still requires high-end interceptors
M6 Define the settlement	Duration and credibility of the strategy	Converts a maintained condition into a verified one	Relief funds rearmament if verification is weak

9.1 Instruments

The six measures are carried out through specific instruments of diplomacy, law, military posture, resource policy, and supply interdiction. Annex D lists 21 of them with the ledger entry each one changes, its direction, its principal constraint, and its source; Table 8 summarizes them. An instrument appears only if it moves a named entry in Table 2, Table 2b, Table 3, or the endurance tables (Tables 4 and 5). Directions are qualitative unless a figure already appears in Annex A. Several instruments are assessed for their effect on the durability of the coalition and not only on U.S. cost, because allied tolerance is one of the two constraints that bind (Table 5).

Table 8. Instruments by domain (full matrix in Annex D)

Domain	Instruments (numbered as in Annex D)	Measures served
Diplomacy	1 multinational transit and mine-clearance mission; 2 cost sharing on the 1991 model; 3 partner supply guarantees; 4 defined settlement with escrowed relief and snapback; 5 humanitarian payment channel	M1, M2, M6
Law	6 congressional authorization; 7 blockade-law compliance; 8 secondary sanctions on financing channels and shadow-fleet services; 9 export-control priority list for reconstitution inputs; 10 multiyear procurement and Defense Production Act authority; 11 enforcement on Russian crude after transit is secured	M1 to M6
Military	12 low-cost counter-drone effectors; 13 allied co-production and second sources; 14 low-cost strike for conditional re-strike; 15 allied mine countermeasures and escorts; 16 hardening and repair of bypass infrastructure	M1, M2, M5; R1
Resources and supply interdiction	17 Caspian and land-border routes; 18 interdiction of inputs at the port of export; 19 Strategic Petroleum Reserve refill on a published schedule; 20 export capacity and backfill of partner shortages; 21 critical minerals with military uses	M1, M2, M4, M5

Priority order. The strait comes first, because nearly every unfavorable entry in the ledger runs through the oil price (instruments 1, 15, 16). Cost sharing is second: it moves the fiscal exchange by the largest factor at the lowest risk, and it is more plausible once prices have fallen (2, 3, 20). Interceptor conservation is third, because it is the one entry where delay favors China (10, 12, 13, 21). The settlement definition is fourth, because it makes duration credible (4, 6). Financing closure is fifth: it extends the effect of denial without raising intensity (8, 9, 17, 18). Russia is last (11), because pressure on Russian barrels before transit is secured raises prices for the partners whose tolerance the strategy depends on.

Limits. None of these instruments makes a change of government likely; they serve containment and disarmament. Several trade against one another: designations that close Iranian financing raise the cost of cooperation with Beijing elsewhere, and the humanitarian channel and blockade-law compliance support allied consent while lengthening Iranian subsistence. Any instrument that raises intensity spends interceptors, the resource the United States is shortest of. The matrix does not change the conclusion of this paper. It shows what would have to be done for the position to become favorable beyond Iran.

10. Forward posture: a conditional escalation framework

Part II describes the war through the data cutoff, and Section 9 the measures that improve the exchange. The remaining question is how to hold the position militarily.

The framework below treats escalation as a cost to the imposing state: every rung above baseline raises U.S. expenditure, mostly in munitions that are already scarce, so the rational posture is to stay on the lowest rung that preserves denial and to make Iran bear the cost of any move upward.

Table 3. Escalation rungs, triggers, and effect on the exchange

Rung	Content	Trigger	Effect on cost exchange	Assessment
R0 Baseline denial	Blockade, financial sanctions, escorted transit; defensive fires only	Default	CBO \$2-3B per month [3]. RBR most favorable	Preferred steady state
R1 Conditional re-strike	Limited strikes on identified reconstitution of missile, drone, naval, or nuclear capacity, and on launch sites after an attack	Confirmed rebuilding, or attack on U.S. or partner forces	Iran pays capital and time to rebuild under import denial; the U.S. pays for a strike package. Favorable while targets can be found	Core of the strategy. Erodes as production disperses into small workshops
R2 Infrastructure strikes	Power generation, bridges, oil and energy infrastructure, which Secretary of War Hegseth named on 8 April as the next targets had Iran refused terms [57]	Mass-casualty attack; collapse of talks	Large one-time damage to Iran; removes Iran's remaining stake in restraint toward Gulf energy and water infrastructure; raises prices for partners	Dominated except in response to a mass-casualty attack. Legal limits apply [56]
R3 Renewed large-scale air campaign	Repeat of Phase 1	Major Iranian offensive; nuclear breakout	Opening rate about \$1.9B per day [4]; consumes interceptors and standoff weapons faster than they are built	Would not be lost militarily. Sets replenishment back by years
R4 Limited seizure	Kharg Island or other offshore export infrastructure	Failure of maritime enforcement	Adds garrison, resupply, and casualty exposure 33 km from the mainland; adds no denial while the blockade holds	Dominated by R0. Contingency only
R5 Invasion and occupation	Ground campaign on the mainland	None identified	Reverses the asymmetry: the imposer's cost becomes open-ended	Excluded

R1 is where the asymmetry compounds. Under import denial, every rebuilt production line costs Iran scarce foreign exchange, smuggled components, and months. Destroying it costs the United States one strike package. The closest precedent is the containment of Iraq in the 1990s, including Operation Desert Fox in December 1998, a four-day air and cruise-missile campaign against Iraqi weapons programs conducted without ground

forces (see U.S. Department of Defense, Operation Desert Fox briefings, December 1998; Congressional Research Service reporting on Iraq, 1998-99). The limit is target discovery. Iran activated a dispersed command and production model after 28 February [58], and one-way attack drones can be assembled in small workshops. U.S. intelligence assessed in April that Iran retained significant launch capacity despite the campaign [34]. R1 suppresses reconstitution of large systems; it does not eliminate low-cost attack capability.

R3: the United States would not lose, and that is not the test. Phase 1 established air superiority within a day and struck 13,000 targets in 38 days with the loss of a small number of aircraft [33, 3]. Nothing in the public record suggests a second campaign would go differently. The constraint is what it would consume. CBO reports that one-half to two-thirds of interceptors may have been used since June 2025 and that replenishment takes at least five years [3]. A second campaign at Phase 1 intensity would draw on the same inventories the 2,000-per-year PAC-3 plan is meant to rebuild. Military success would also leave the political question where it stands now: the first campaign did not produce a change of government.

R4: Kharg Island is dominated by the blockade. The island handles about 90 percent of Iran's crude exports [45]. In March the administration weighed seizing it, and Marine expeditionary units and elements of the 82nd Airborne deployed to the region [53]. The expert objections were consistent. A garrison would sit about 33 kilometers from a mountainous coast from which missiles, drones, and artillery can be fired with little warning; Iran could stop the flow at the upstream end of the pipelines; and a sea blockade of tankers achieves the same denial at lower risk [54, 55, 56]. Events bore this out: the blockade brought Kharg loadings to a halt by mid-May without a landing [59]. The general point is that a maritime blockade already performs the resource-restriction function that any limited ground seizure would serve. It controls the export stream at the point of shipment instead of the point of loading, from mobile platforms at standoff distance instead of a fixed position offshore, and with no garrison to supply or defend. The objective of a Kharg operation has been met as a by-product of the blockade. Seizure remains a contingency if maritime enforcement fails, or as collateral in a negotiation. It is the only ground option consistent with the logic of denial, and it is not currently needed.

R5 is excluded. Iran has roughly three and a half times the population and nearly four times the area of Iraq in 2003 (about 90 million against 26 million people; 1.65 million against 0.44 million square kilometers; World Bank and CIA World Factbook), where a U.S. force that peaked near 170,000 during the 2007 surge (Brookings Iraq Index) did not secure the country. No regional partner has offered basing for an invasion, U.S. public support is absent, and an occupation would convert a bounded annual cost into an unbounded one. It would abandon the premise of the strategy.

11. Endurance: whose constraints bind first

A claim that Iran cannot sustain the blockade beyond some number of years needs to specify what fails. Published estimates differ by an order of magnitude because they measure different things.

Table 4. Iranian endurance horizons under continuous blockade

Horizon	Evidence	Estimate
Military-industrial reconstitution	Imports of machine tools, components, and propellant precursors blocked; export revenue near zero	Denied now, for as long as enforcement holds
Refined fuel	Senior Iranian officials told Reuters in early September that about two months of gasoline remained [50]	Weeks to months; rationing extends it
Accessible foreign exchange	Capital Economics: no more than three months of pre-war imports [47]. Iran Open Data: \$61B in manageable reserves, about one year of imports [46]. The oil ministry says \$7.5B transferred over four months covers needs to early January 2027 [49]. The June-July pause allowed about \$6B in sales [48]. Oil already at sea runs out about mid-October and payments largely end by mid-December [68]	Likely exhausted between late 2026 and mid-2027
Subsistence	\$45B in gold covers about three years of basic food and medicine [48]. Overland and Caspian routes replace under 10% of Gulf throughput [51], though at least 35 million tons of trade can be rerouted [52]	About three years; longer with outside financing
Government survival	System consolidated under hard-liners [35]; central bank governor denies collapse is possible [52]; one assessment holds the economy may outlast the current U.S. administration [48]	Indeterminate. Not a function of the horizons above

The defensible statement is this. Under continuous blockade Iran likely loses the ability to stabilize its currency and finance normal imports within about a year, and likely exhausts its subsistence buffer within about three. President Pezeshkian has said trade is down 25 to 35 percent [49], monthly inflation reached 8.8 percent in May [7], and the government is meeting obligations by printing money [48]. That path leads to hyperinflation and a barter and border-trade economy. It does not lead by any identified mechanism to a change of government, and the first of these estimates, three months of reserves in April, has already passed without visible collapse. Analysts have tended to underestimate Iranian endurance.

The principal counter-strategy is outside financing. If essential imports cost on the order of \$15 billion a year, as the gold figure implies, China or Russia could sustain Iranian subsistence overland for a sum that is trivial to either. That would not restore Iran's military industry or its export revenue, but it would extend the subsistence horizon

indefinitely, as Chinese support has done for North Korea. Secondary sanctions on the financing channels are the available response (Section 9, M4).

Table 5. U.S. endurance at baseline denial

Constraint	Status	Binding?
Fiscal	\$24-57B per year; 0.07-0.18% of GDP	No
Munitions	Low consumption at R0; production rising from about 600 to 2,000 PAC-3 per year by 2030 [26]. Denial-phase interceptor consumption is not published	Only if intensity rises to R2-R3
Energy	Record production (13.8 mb/d forecast, September 2026 STEO as reported) and exports [16, 20]; SPR at a 44-year low with loans due back by Sept 2028 [19, 21]	Partly. Little reserve against a second shock
Domestic politics	Rising opposition in polls; midterms in November; next presidential transition January 2029 [1]	Yes
Allied tolerance	Partners bear most of the price shock (Table 2)	Yes

The comparison supports the central claim with one correction. The United States can sustain baseline denial materially for longer than Iran can sustain macroeconomic function, by a wide margin. What limits the United States is not money or, at this intensity, munitions. It is whether successive administrations and partner governments choose to continue. Iran's leadership understands this, which is why its settlement terms have not moved. A strategy that depends on outlasting the target has to make its own duration credible; statements tying the war's end to the U.S. electoral calendar work against it.

12. Implications for China and Russia

The hemispheric actions and the Iran war share a stated logic, not a documented plan. The December 2025 National Security Strategy commits the United States to "deny non-Hemispheric competitors the ability to position forces" or to control strategically vital assets in the Western Hemisphere [100, 101]. That is the declared purpose of the actions against Venezuela and Cuba, and the competitors it refers to include China, Russia, and Iran. The public record does not show that those actions were sequenced as preparation for the war with Iran, and this paper does not claim that they were. It records the effect: within a year three governments aligned with Beijing and Moscow were removed, isolated, or blockaded, two of them suppliers of sanctioned crude to China, and in no case did either patron contest the action.

China: the lasting effect is the loss of sanctioned supply. Iran supplied roughly one million barrels a day and Venezuela about 0.47 million, together about 12 percent of China's pre-war imports (Sections 6.1 and 6.3). Those barrels moved through channels built to avoid U.S. financial measures. Their replacements are bought at market prices

from suppliers who are exposed to that reach. China has also drawn down part of the reserve it built in 2025 and has observed a distant blockade enforced for months with Gulf state cooperation. Annex C shows what that means in a wider contingency: seaborne access and willingness to ration determine China's endurance, not its overland pipelines.

The lever depreciates. A strategy of denial teaches its targets and their patrons to harden. China's gasoline and diesel use fell 13 and 17 percent year on year as new-energy vehicles displaced demand [13], it built stocks at more than a million barrels a day in 2025, and its power system does not run on oil. Each year of that adjustment reduces what seaborne interdiction can threaten. The period in which the lever is most valuable, the late 2020s, is also the period in which U.S. interceptor stocks are lowest. M5 is therefore the measure on which the China implications depend.

Russia and China are pushed together commercially, with a mixed result. Russia's share of China's seaborne crude imports reached 25 percent in July [67]. That binds the two more closely and gives Moscow a larger claim on Beijing. It also concentrates China's supply on an exporter whose western loading ports and feeder network are within demonstrated Ukrainian strike range (Section 6.2, cases S4a and S4b). The United States does not control that variable, but it bears on how much comfort Beijing can take from Russian supply.

Patron credibility was lost cheaply. The cargo that relieved Cuba for nine or ten days was worth about \$66 million, and the constraint on Moscow was U.S. permission, not money (Section 6.3). Essential Iranian imports run on the order of \$15 billion a year. Neither patron has chosen to pay even those sums in the face of U.S. action. The loss of standing among their remaining clients is real and is not measurable from the public record. It should be claimed as an observed pattern of non-intervention, not as a quantified cost.

13. Conditions for a favorable exchange, and standing predictions

Against Iran the exchange remains favorable while three conditions hold: the U.S. cost of denial stays below \$4.6 billion a month; enforcement keeps Iranian seaborne exports near zero; and outside financing stays below the level that funds rearmament. Beyond Iran it becomes favorable only if three more are met: prices fall because transit is secured while the blockade continues (M1); interceptor production outpaces consumption, which requires that intensity stay at baseline (M5); and partner governments continue to accept the residual cost or share it (M2). A defined settlement (M6) is what allows the position to end on U.S. terms instead of on the U.S. electoral calendar.

Table 6. Standing predictions

ID	Prediction (author's estimative judgment)	Resolution and falsifier
SP-1	The Pentagon's reported cumulative cost, on the series that includes fuel (\$45.1B as of 3 Sept 2026), will likely (about 70%) be below \$75B on 28 Feb 2027, absent a second major air campaign. The CBO rate projects about \$57-63B and the Pentagon-series rate about \$73B (Annex A), so the threshold sits above both.	Resolves on the last Pentagon figure reported to Congress on or before 28 Feb 2027. False if that figure is \$75B or more without a new campaign: the denial phase is not cheap. Void if a second major air campaign occurs.
SP-2	While the blockade is in force, Iranian seaborne crude that clears the blockade zone, as measured by independent tanker trackers, will likely (55-80%) remain below 15% of the pre-war volume of 2.1 mb/d in every calendar month through 30 June 2027.	False if Kpler, Vortexa, or TankerTrackers data show two consecutive months at or above 15% (about 0.32 mb/d).
SP-3	China's crude imports (EIA or China customs monthly data) will likely (55-80%) return above 10 mb/d within two quarters of sustained Hormuz flows above 15 mb/d, as estimated in EIA's Short-Term Energy Outlook or, failing that, by Vortexa or Kpler.	False if imports remain below 10 mb/d four quarters after normalization: the cost to China is structural, not transitory. Void if Hormuz flows have not been sustained above 15 mb/d by 31 Dec 2027.
SP-4	Economic pressure alone is unlikely (about 20-25%) to produce a change of government in Iran before 30 Sept 2027. A change of government means that the office of Supreme Leader is abolished or its holder is removed by domestic actors, or the IRGC command ceases to answer to it.	False if such a change occurs by that date and was not preceded by invasion or produced by a negotiated transition.
SP-5	PAC-3 MSE deliveries for calendar 2027, as reported by Lockheed Martin in its annual results or by the Department of Defense in budget justification documents by 31 March 2028, will likely (55-80%) fall between 750 and 1,100.	False if fewer than 750 (the industrial return is slipping) or more than 1,100 (replenishment is faster than this paper assumes). Void if neither source reports a figure by that date.
SP-6	If the blockade is continuous, Iran will likely (about 65%) lose the ability to defend its currency by 30 June 2027, indicated by an open-market rate weaker than 4 million rials per dollar. The rate was about 1.3 million in April 2026; inflation near 69 percent would by itself carry it to roughly 2.2-2.4 million, so the threshold requires depreciation well beyond ambient inflation.	False if the rate is stronger than 4 million on that date with the blockade continuous: accessible reserves or outside financing are larger than estimated. Void if the blockade is lifted for more than 30 days.

Probability terms follow the Intelligence Community Directive 203 bands: likely 55-80 percent; unlikely 20-45 percent. Predictions were fixed on the date of this version. A later version will score them, including by Brier score, and will not amend them.

14. Conclusion

Against Iran, the denial phase of the 2026 Iran war is a favorable position for the United States, and the reason is endurance. A cost of 0.07 to 0.18 percent of GDP, which the United States can carry without limit, removes about \$55 billion a year of export revenue from an economy the air campaign had already damaged, and denies Iran the revenue,

payment channels, and imported inputs it needs to rebuild military industry. In dollars the exchange is near parity: favorable while denial costs less than \$4.6 billion a month, as it does at the CBO rate, and slightly unfavorable at the rate the Pentagon series implies. The relative-burden ratio adds nothing to that beyond the relative size of the two economies.

Beyond Iran the position is not yet favorable, and the paper has tried to say so plainly. China has lost sanctioned supply and drawn down reserves, but its cash import bill was roughly unchanged at the cutoff, its adjustment away from oil continues, and the depletion of U.S. interceptors improves its relative military position until about 2029. Russia gains while prices stay high. U.S. partners bear most of the price shock, and if the contest of the strait is counted as a cost of the blockade the coalition-level exchange is unfavorable in dollars. Read as a regional war, the conflict looks like an expensive stalemate. Read as a system-wide event, it is a strong position against one adversary and an unfinished one against the other two.

What finishes it is identifiable. Nearly every unfavorable entry runs through the oil price, and the oil price is set by the contest of the strait, not by the blockade of Iranian ports. Securing transit while denial continues lowers partner costs, removes the Russian windfall, and eases the domestic constraint, without restoring a barrel of Iranian exports. Partner cost-sharing on the 1991 model changes the fiscal exchange by a multiple. Holding intensity at baseline denial with conditional re-strike, and moving drone defense to low-cost effectors, lets interceptor production overtake consumption. Closing outside financing keeps Iranian subsistence from becoming Iranian rearmament. A defined settlement gives the strategy an end that does not depend on the U.S. electoral calendar.

The historical record supports the narrower objective and not the wider one. Containment disarmed Iraq and did not change its government. The same should be expected here. Success should be measured by Iranian rearmament and proxy finance, which the strategy can control, and not by regime change, which it cannot. Iran's economy likely cannot maintain normal function past mid-2027 under continuous blockade; its government may persist well beyond that. The United States can afford the blockade indefinitely. Whether it does the six things that make the blockade worth affording is the variable on which the strategy turns.

Annex A. Arithmetic

Quantity	Calculation	Result
Phase 1 opening daily rate	\$11.3B / 6 days	\$1.88B per day
Denial-phase observed daily rate	(\$43.6B - \$33.4B) / 65 days (30 Jun to 3 Sep)	\$0.157B per day; ratio to opening rate about 1:12
Denial-phase annual cost, observed (upper bound)	\$0.157B x 365	\$57.3B
Denial-phase annual cost, CBO	\$2-3B x 12	\$24-36B
U.S. burden	\$24-57B / \$32,380B GDP	0.074-0.177%
First-year U.S. total (to 28 Feb 2027)	\$45.1B + 5.9 months x (\$2.0B to \$4.7B)	About \$57-73B
Iranian GDP (IMF WEO)	Pre-war, April 2025 edition; 2026, April 2026 edition	\$361B; \$300B (check: FDD-implied \$144B / 0.40 = \$360B)
Iranian annual output loss	\$361B x (0.15 to 0.25)	\$54-90B
CER, Iran, total war-attributable (mixes phases)	\$54B / \$57.3B to \$90B / \$24B	About 0.94:1 to 3.75:1
RBR, Iran, total war-attributable (mixes phases)	15% / 0.177% to 25% / 0.074%	About 85:1 to 337:1
CER, Iran, blockade-attributable (exports)	\$55B / \$57.3B to \$55B / \$24B	About 0.96:1 to 2.29:1 (preferred basis)
Break-even U.S. cost of denial	\$55B / 12	\$4.58B per month; CBO \$2-3B; Pentagon observed \$4.77B
Numerator sensitivity: oil and refined products only (\$45B)	\$45B / 12; \$45B / U.S. cost	Break-even \$3.75B per month; CER 0.79:1 to 1.88:1; at CBO high rate 1.25:1 (with LPG: 1.53:1)
RBR identity	RBR = CER x (U.S. GDP / Iran GDP): \$32,380B / \$361B (pre-war) and / \$300B (wartime)	CER x 89.7 to CER x 107.9
RBR, Iran, exports, wartime GDP base (upper end)	(\$55B / \$300B = 18.3%) / U.S. burden	About 104:1 to 247:1
RBR, Iran, blockade-attributable (exports)	(\$55B / \$361B = 15.2%) / 0.177% to / 0.074%	About 86:1 to 206:1 (derived)
RBR, Iran, FDD one-third share	(\$18-30B / \$361B) / U.S. burden	About 28:1 to 112:1
Bias stress test	U.S. cost x 1.5 = \$86B against \$55B	CER 0.64:1; RBR about 57:1
U.S. gross price effect (economy-wide ledger)	20.6 mb/d x \$28.19 x 365	\$212B per year gross (0.65% of GDP); largely a transfer to U.S. producers
Coupled case: parity share	(\$55B - \$24B) / \$750B world loss at market rates	4.1% at the CBO low rate; below parity at any share on the Pentagon rate

Quantity	Calculation	Result
Cost-sharing, fiscal CER	$\$55B / ((1 - s) \times \text{U.S. cost}); s = 0.5 \text{ and } s = \$54B / \$61B$	$s = 0.5: 1.9:1 \text{ to } 4.6:1; s = 0.89: 8:1 \text{ to } 20:1$
Sanctioned supply lost by China	$(1.0 + 0.47) \text{ mb/d} / 12.0 \text{ mb/d}$	About 12% of pre-war imports
WTI change, year on year	$\$92.55 - \64.36	$\$28.19 (+43.8\%)$
China gross price effect	$8.1 \text{ mb/d} \times \28.19×365	$\$83.3B \text{ per year}$
China cash import bill, pre-war pattern	$12.0 \text{ mb/d} \times \64.36×365	$\$281.9B$
China cash import bill, Q2 2026 pattern	$8.1 \text{ mb/d} \times \92.55×365	$\$273.6B \text{ (change } -8.3B)$
China reserve draw, upper bound	$14.75 - 4.32 - 8.1 \text{ mb/d}$	$2.33 \text{ mb/d (850M bbl per year)}$
China refill liability, upper bound	$2.33 \text{ mb/d} \times \28.19×365	$\$24.0B \text{ per year}$
China burden, gross basis	$\$83.3B / \$20,850B \text{ GDP}$	0.40%
RBR, China, war-attributable, gross	$0.40\% / 0.177\% \text{ to } 0.40\% / 0.074\%$	About 2.3:1 to 5.4:1
IEP global loss at market rates	$0.6\% \times \$124\text{-}126T$	About $\$0.75T$ (IEP states $\$1.3T$ in PPP terms)
Russian cargo to Cuba	$730,000 \text{ bbl} \times \text{about } \90	About $\$66M$

All rows are computed from WP-2026_Asymmetric_Denial_inputs.csv at build time. GDP denominators are IMF WEO April 2026 projections read through relays. WTI is a proxy for the delivered price of Chinese imports; a Brent or Dubai basis would be more appropriate and may differ by several dollars. The reserve draw is an upper bound because it holds refinery runs at the 2025 level while observed fuel demand fell.

Annex B. Sources and confidence

Each quantitative claim is listed with its source and tier. PRIMARY: the official or originating source. SECONDARY: a reputable report of a primary source. AUTHOR ESTIMATE: a calculation shown in Annex A or the inputs file. AUTHOR JUDGMENT: an assessment that the cited evidence supports but does not state. Where a claim rests on a single outlet, on an outlet with a declared position, or on a belligerent's own account, the basis column says so. Sources were retrieved between 19 and 21 September 2026.

Claim	Ref.	Tier	Basis and limits
$\$43.6B / \$45.1B$ Pentagon cost; composition	[1, 2, 5]	SECONDARY	Congressional reporting of a Pentagon submission.
CBO about $\$38B$ as of 1 Aug; $\$2\text{-}3B$ per month; one-half to two-thirds of interceptors; at least five years; $+0.5$ pt inflation	[76, 77, 3]	PRIMARY for the estimate; SECONDARY for components	CBO letter 62756; component breakdown and interceptor range from press reports of the letter.

Claim	Ref.	Tier	Basis and limits
\$11.3B in first six days	[4]	SECONDARY	Single outlet reporting a closed briefing.
Blockade dates (13 Apr; 18 Jun; 14 Jul)	[25, 18]	SECONDARY	Tertiary source used for dates only.
CENTCOM tallies: 121 redirected (1 June); 105 (18 Sept); 1B barrels; 2,000 transits; mine clearance; zero Iranian exports	[79, 24, 22]	SECONDARY	A belligerent's account, relayed from statements posted to X. The two vessel counts are period-specific. The zero-export claim is compared with tanker-tracking data in Section 6.1.
Blockade-attributable numerator: \$55B per year of hydrocarbon exports	Section 7; Annex A	AUTHOR ESTIMATE	Iran Open Data attributes the \$45B for oil and refined products to OPEC; the \$10B LPG component is its own figure without upstream attribution, and Section 5 gives the result without it. Revenue, not value added; omits blocked imports; realized receipts were lower.
Iranian nominal GDP: \$361B pre-war (IMF, April 2025); \$300B for 2026 (IMF, April 2026)	[87]	SECONDARY	The 2026 figure was read through a relay of the April 2026 database (\$300.29B); the pre-war figure has not yet been read from the database and agrees with the \$360B implied by the FDD estimate. IMF conversion is near the official exchange rate, not the open-market rate.
Iranian exports 2017 to 2020 under sanctions alone; recovery to 1.8 mb/d by Sept 2024	[88, 89]	PRIMARY (EIA); SECONDARY (S&P;)	Basis for the enforced-sanctions baseline in Sections 2.4 and 5.
FDD \$144B, range, two-thirds / one-third split; half of direct damage to military and nuclear assets	[6, 7]	SECONDARY	FDD advocates a hard line on Iran. The half-of-damage figure is a direct quotation of the estimate's author in the May account and is excluded from the June summary.
IEP GDP -15 to -25%; damage \$80-350B	[8]	SECONDARY	Modelled scenario.
IEP world loss: \$1.3T and 0.6% of world output, Scenario 2; about \$0.75T at market rates	[9, 8, 78]	PRIMARY summary; AUTHOR ESTIMATE for the conversion	The two IEP figures reconcile in purchasing-power-parity terms. The market-rate conversion is the author's.
IMF -6.1%, inflation 68.9%; rial near 1.3 million	[10]	SECONDARY	Press report of the April 2026 WEO; the rial rate is not independently confirmed.
China imports 8.1 mb/d, -32% q/q; 12.0 mb/d pre-war; record 2025	[12]	PRIMARY	
China inventories 1,541M bbl (EIA); 1.9B bbl (Goldman)	[15, 13]	SECONDARY	

Claim	Ref.	Tier	Basis and limits
U.S. exports 13.6 mb/d; crude 5.6 mb/d	[16]	PRIMARY	
U.S. petroleum consumption 20.6 mb/d (2025)	[93]	PRIMARY	
LNG 17.0 Bcf/d forecast	[17]	PRIMARY	April 2026 STEO.
SPR 285.4M bbl; loan structure to Sept 2028; East-West pipeline shutdown and Brent above \$108	[19, 21]	SECONDARY	
Hormuz bypass capacity: East-West 5 mb/d, run at 7; UAE line 1.8 mb/d; about 2.6 mb/d spare before the war; second UAE line in 2027	[90, 91, 92]	PRIMARY (EIA); SECONDARY (wire reports)	
PAC-3 600 to 2,000; THAAD 96 to 400; contract values; CSIS inventory estimates	[26, 27, 29, 30]	PRIMARY for the PAC-3 framework; SECONDARY otherwise	THAAD contract value and on-hand estimates are from trade press.
Guided rocket about \$35,000 a round; medium-range air-to-air missile about \$1M	[103]	SECONDARY	Trade press quoting the Air Force chief of staff.
Statements on targets struck; intelligence assessment of retained launch capacity	[31, 34]	SECONDARY	Official claims are of targets attacked, not verified destruction.
1991 burden sharing: about \$54B pledged, \$50.5B received by Nov 1991, against a \$61B cost estimate	[94, 95]	PRIMARY (GAO); SECONDARY (UPI)	
Iraq 1991-2003: programs ended, no stockpiles, sanctions constrained imports and decisions; erosion by 2000-01; monitoring judgment	[96, 97, 98]	PRIMARY report cited through SECONDARY accounts of it	Findings are taken from contemporaneous summaries and testimony, not from a page-by-page reading of the report.
Annual cost of containing Iraq, about \$19B	[99]	SECONDARY	One academic estimate, from the 2003 essay version as summarized in later literature.
2025 National Security Strategy: Western Hemisphere passage; burden sharing	[100, 101, 102]	PRIMARY document cited through SECONDARY summaries	Supports the declared purpose of the hemispheric actions. It does not support a claim that they were sequenced ahead of Iran.
Venezuela 470 kb/d, 4.5%; debt about \$60B	[39, 40]	SECONDARY	Debt estimates vary widely across sources.
SIPRI export shares	[36]	PRIMARY	

Claim	Ref.	Tier	Basis and limits
China CPI +0.8% August	[41]	PRIMARY	
WTI \$92.55 (3 Sept 2026) and \$64.36 a year earlier	[61]	SECONDARY	EIA series RWTCD read through a relay. WTI is a proxy for the delivered price of Chinese imports.
China cost on three bases (gross, cash, refill)	Table 2a; Annex A	AUTHOR ESTIMATE	Sensitive to benchmark and date; the cash-bill sign flips at a 48.1% price rise.
China refinery runs 14.75 mb/d; domestic output 4.32 mb/d (2025)	[63]	SECONDARY	Reuters report of NBS data.
Russia to China 2.17 mb/d (2024); ESPO spur 0.6; Kazakhstan 0.2	[64, 65]	SECONDARY	2024 volumes.
Hormuz-transiting crude to China: 5.4 mb/d (45% of pre-war imports)	[82, 83, 84]	SECONDARY	China's share of EIA chokepoint flows. Customs data give 36-40% but omit relabelled Iranian crude; both bounds are in Table C4.
CREA July 2026: ESPO grade 74%; Russia 25% of China seaborne imports; product loadings record low; pipeline earnings -21%	[67]	PRIMARY	
Usable fraction of stocks: 90%	[80, 81]	PRIMARY for the convention	Applied to Chinese storage by analogy. Table C3 shows the sensitivity.
Deepest Ukrainian strike about 2,840 km (9 Sept 2026); prior about 2,500 km (Omsk, July); distances to Skovorodino and Kozmino	[85, 86]	SECONDARY; AUTHOR ESTIMATE for distances	Great-circle estimates.
Iranian oil at sea: about 180M bbl (late Apr), 80M (late Aug), 29M outside the blockade zone (early Sept, from 90M mid-July); China imports of Iranian crude 823 to 534 kb/d	[46, 68, 69]	SECONDARY	Kpler and Reuters data through relays. The series use different definitions and are not directly comparable.
Iranian loadings 2.1 mb/d (Feb), 0.57 mb/d after 13 Apr, zero in May; \$45B oil exports, \$10B LPG (2025)	[46, 7]	SECONDARY	The zero-export account for May conflicts with the 0.57 mb/d figure and with shadow-fleet reporting.
Russia supplying upgraded drones, components, and imagery to Iran in 2026	[70, 71]	SECONDARY	U.S. and European officials cited by AP; the Kremlin denies it.
Cuba: fuel exhausted 13 May; 20+ hour outages; five national grid collapses by mid-July; surgeries cancelled; Russian cargo of 730,000 bbl	[72, 73, 37, 74]	SECONDARY	Wire reports through relays.

Claim	Ref.	Tier	Basis and limits
Russian oil tax receipts roughly doubled March to April; export earnings at a two-year high	[60]	SECONDARY	Tertiary relay of a Reuters calculation and CREA data. The Russia finding depends on it.
Box 1 channel assignments	Section 1	AUTHOR JUDGMENT	Each row is supported in Sections 4 to 7.
Iranian reserve and endurance estimates (3 months; \$61B / 1 year; \$45B gold / 3 years; \$7.5B to Jan 2027; \$6B during the pause)	[47, 46, 48, 49]	SECONDARY	Estimates conflict and are presented as a range. One is cited from its public summary only.
Two months of gasoline	[50]	SECONDARY	Reuters reporting read through an outlet with a declared position.
Output cuts, 30% of reservoirs, shut-in damage disputed	[44, 45]	SECONDARY; PRIMARY for CGEP	
Kharg: 90% of exports; seizure weighed; deployments; expert objections; loadings halted by mid-May	[45, 53, 54, 55, 56, 59]	SECONDARY	
Statement on next targets (power, bridges, energy)	[57]	SECONDARY	AFP report.
Essential imports about \$15B per year	Section 11	AUTHOR ESTIMATE	\$45B divided by three years. Rough.
Desert Fox; Iran/Iraq population and area; peak U.S. force in Iraq near 170,000; Iranian proxy finance	named in text	Standard references named in the text	DoD and CRS; World Bank and CIA World Factbook; Brookings Iraq Index; State Department Country Reports on Terrorism.
U.S. GDP \$32.38T; China GDP \$20.85T; world about \$124-126T (2026)	[62]	SECONDARY	April 2026 WEO through two relays that agree. Nominal GDP is used on both sides of every ratio.
Escort and mine-clearance precedents: Earnest Will, 1987-88 (127 escort missions); allied clearance of about 1,300 mines in 1991; 2026 European statement and Japanese legal constraint	[104, 105, 107, 106]	PRIMARY (CIA study); SECONDARY otherwise	Earnest Will was a U.S. operation with separate allied minesweeping; it is a precedent for escorted transit, not for a multinational command.
Swiss Humanitarian Trade Arrangement, operational 27 Feb 2020	[108]	PRIMARY	
Blockade-law requirements: declaration and notification, effectiveness, impartiality, neutral ports, humanitarian passage	[109, 110]	PRIMARY text cited through a SECONDARY summary	San Remo Manual paragraphs 93-104; the manual is a restatement by experts, not a treaty.
Common High Priority List: 50 items in four tiers, developed with the EU, Japan, and the UK	[111]	PRIMARY	Cited as a model; no such list exists for Iran in the sources used.

Claim	Ref.	Tier	Basis and limits
China's December 2024 export ban on gallium, germanium, and antimony to the United States; suspension to 27 Nov 2026	[112, 113]	SECONDARY	The link from these minerals to interceptor production specifically is the author's judgment.
Table D1 mappings of instruments to ledger entries	Annex D	AUTHOR JUDGMENT	Each row cites the table and row it changes; directions are qualitative.
Sanctions literature in L4	[115, 116]	Literature	

Annex C. China crude-endurance model

Purpose. To show, with stated inputs, how long China's crude inventories cover a supply deficit under present conditions and under progressively tighter constraints. The model is a stress test. Only S0 describes the conflict as of the cutoff; S1 to S4 are hypothetical, and S2 and S3 describe a wartime interdiction that no party has undertaken.

Identity. Days of cover = $I / [R(1 - r) - D - M]$, where I is usable inventory (million barrels), R refinery runs, r the share of runs removed by rationing or demand loss, D domestic crude output, and M imports still arriving (all million barrels a day). The identity ignores product stocks, product imports, and the time needed to reconfigure refineries for different crude grades.

Table C1. Inputs

Input	Value	Source
Refinery runs, 2025 (R)	14.75 mb/d	NBS via Reuters [63]
Domestic crude output, 2025 (D)	4.32 mb/d	NBS via Reuters [63]
Imports, pre-war average	12.0 mb/d	EIA [12]
Imports, Q2 2026	8.1 mb/d	EIA [12]
Crude reaching China through Hormuz	5.4 mb/d (45% of pre-war imports)	China's slice of EIA chokepoint flows, Q1 2025, via AFP; equals Vortexa's 51% of 2025 seaborne imports [82, 83]. Earlier all-Middle-East figure: [66, 14]
Overland pipelines	ESPO spur 0.60; Kazakhstan 0.20 mb/d; both at capacity	[64, 65]
Russian crude to China, 2024	2.17 mb/d total; 1.37 seaborne by subtraction	China customs via Reuters [64]
Non-ESPO share of Russian seaborne crude to China	26% (ESPO grade 74% in July 2026)	CREA [67]
Inventory cases (I)	1,387 / 1,541 / 1,710 M bbl	90% usable under the IEA convention [80, 81]; EIA [15]; Goldman Sachs via Caixin [13]
Consistency check	$11.6 + 4.32 - 14.75 = 1.17$ mb/d implied 2025 stock build	Matches reported stockpiling in 2025 [12]

Table C2. Days and months of cover by scenario

ID	Scenario	Imports (mb/d)	Rationing	Deficit (mb/d)	I = 1,387: days (months)	I = 1,541: days (months)	I = 1,710: days (months)
S0	Observed Q2 2026 imports (8.1 mb/d), runs held at 2025 level: upper-bound draw	8.10	0%	2.33	595 (20)	661 (22)	734 (24)
S0r	S0 with refinery runs down 10%, close to observed demand loss	8.10	10%	0.86	1622 (53)	1802 (59)	2000 (66)
S1	All Hormuz-transiting supply lost (5.4 mb/d, 45% of pre-war imports), no replacement	6.60	0%	3.83	362 (12)	402 (13)	446 (15)
S1r	S1 with 10% demand reduction	6.60	10%	2.36	589 (19)	654 (22)	726 (24)
S4a	S1 plus loss of non-ESPO Russian seaborne crude (Baltic and Black Sea origin, within Ukrainian strike range)	6.24	0%	4.19	331 (11)	368 (12)	408 (13)
S4b	S1 plus loss of all Russian seaborne crude	5.23	0%	5.20	267 (9)	296 (10)	329 (11)
S2	All seaborne imports interdicted; overland pipelines only (0.8 mb/d)	0.80	0%	9.63	144 (5)	160 (5)	178 (6)
S2r30	S2 with 30% rationing	0.80	30%	5.20	266 (9)	296 (10)	329 (11)
S2r50	S2 with 50% rationing	0.80	50%	2.25	615 (20)	683 (22)	758 (25)
S3	S2 plus loss of the ESPO spur (Kazakhstan line only, 0.2 mb/d)	0.20	0%	10.23	136 (4)	151 (5)	167 (5)
S3r30	S3 with 30% rationing	0.20	30%	5.80	239 (8)	265 (9)	295 (10)

Reading the table.

- S0 is an upper bound on the second-quarter 2026 draw. Observed fuel demand fell 13-17 percent, so S0r is closer to what is happening, and at that rate cover exceeds three years. China was under no near-term physical constraint.
- S1 removes all supply that transits Hormuz, including Iranian crude that Chinese customs records under other origins. The strait is contested, not closed, and Gulf

cargoes that moved in the second quarter went mainly to other Asian buyers, so S1 is a severe case, not a forecast.

- S4a and S4b add Russian losses to S1. The exposed Russian volume is small because most of China's Russian crude moves through Pacific ports and overland lines. The net effect of refinery strikes on crude exports is ambiguous and is not modelled.
- S2 and S3 are the wartime interdiction cases. The difference between them, the ESPO spur, is about 0.6 million barrels a day against a deficit near 10. Rationing is the variable that matters: moving from none to 30 percent roughly doubles cover.
- The usable fraction is 90 percent, following the IEA convention that 10 percent of stocks are unavailable, applied to the low and high inventory cases; the middle case is the unadjusted EIA figure, kept as a bracket. The convention concerns tank bottoms. It is a different quantity from the share of inventories usable without operational stress, which JPMorgan put near one-tenth for global stocks in April (Section 8, L2); that measure describes commercial stocks needed to keep a supply system running, while most of the Chinese figure is strategic storage held for drawdown. The true usable share lies between the two, and Table C3 shows the sensitivity down to 50 percent.
- The Hormuz input is contested. Chinese customs data list Gulf suppliers at about 36 to 40 percent of imports [84], but omit Iranian crude recorded as Malaysian. EIA's direct measure of 5.4 million barrels a day includes it and is used here as the upper, more conservative figure. Table C4 shows the range.
- All results are central estimates with error in both directions, for the reasons given in Section 6.2. The model places no limit on the rate at which storage can be drawn, which matters most in S2 and S3.

Table C3. Sensitivity of S2 (full interdiction, no rationing) to the usable fraction of 1,541 M bbl

Usable fraction	Usable stock (M bbl)	Cover
0.50	770	80 (3) days (months)
0.65	1002	104 (3) days (months)
0.90 (used)	1387	144 (5) days (months)
1.00	1541	160 (5) days (months)

Table C4. Sensitivity of S1 to the Hormuz-transiting volume (I = 1,387 M bbl)

Measure	Volume lost (mb/d)	Deficit (mb/d)	Cover
Customs-listed Gulf suppliers only, excluding relabelled Iranian crude (about 36%)	4.32	2.75	504 (17) days (months)
EIA direct measure, Q1 2025 (used)	5.40	3.83	362 (12) days (months)
All Middle East (48%)	5.76	4.19	331 (11) days (months)

A replication script, `WP-2026_china_crude_endurance_model.py`, is distributed with this paper. It reads the same inputs file as this document and reproduces Table 2a, Table 2b, the exchange rows of Annex A, and Tables C2 to C4, and writes them to CSV.

Annex D. Instrument matrix

Each instrument is mapped to the measure it serves (Section 9) and to the ledger entry it changes. Rows cite the table and row. Precedents are cited or omitted. The matrix is at the level of policy; it contains no operational detail.

Table D1. Instruments, the measures they serve, and the ledger entries they change

Instrument	Meas.	Ledger entry changed	Direction	Principal constraint	Source
Diplomacy					
1. Multinational transit and mine-clearance mission. Precedents: U.S. escort of reflagged tankers, 1987-88; allied clearance of about 1,300 mines in 1991	M1	Table 2, partners row; Table 2b; Table 5, allied tolerance	Price shock falls; coalition exchange moves toward the separable case	Iran still decides whether to contest transit. Some partners can clear mines only after fighting ends	[104, 105, 107, 106]
2. Cost sharing on the 1991 model	M2	Table 2, U.S. row; Table 5, fiscal; Annex A, cost-sharing row	Fiscal CER rises by $1 / (1 - s)$	Partners already pay through prices; no mandate comparable to 1991	[94, 95]
3. Partner supply guarantees: U.S. crude, LNG, and LPG under term contracts	M1, M2	Table 2, partners row; Table 5, allied tolerance; Box 1, channel 7	Partner exposure to shortage falls; the U.S. export gain becomes an alliance asset	Terminals near maximum utilization; contracts are commercial and gains accrue to private producers	[16, 17]
4. Defined settlement with escrowed relief and snapback	M6	Table 5, domestic politics	Duration becomes finite and credible	Relief funds rearmament if verification is weak	[7, 97]
5. Humanitarian payment channel on the 2020 Swiss model	M2, M6	Table 5, allied tolerance; Table 4, subsistence	Supports partner consent (L7). Lengthens Iranian subsistence, which is adverse to denial	Diversification; the channel works against the subsistence horizon by design	[108]
Law					
6. Congressional authorization for the blockade	M6	Table 5, domestic politics	Commitment is credible beyond November 2026 and January 2029	A failed vote is worse than no vote	[1]

Instrument	Meas.	Ledger entry changed	Direction	Principal constraint	Source
7. Blockade-law compliance: declared, effective, impartial, with humanitarian passage	M1, M2	Table 5, allied tolerance	Sustains neutral, partner, and insurer cooperation (L7)	Humanitarian passage and access to neutral ports limit what can be stopped (Table 4, subsistence)	[109, 110]
8. Secondary sanctions aimed at financing channels and at the services that support the shadow fleet, not at barrels	M4	Table 4, foreign exchange and subsistence	Outside support held below the level of rearmament	Cost with Beijing rises with each designation; designations must be sequenced	[48, 46, 69]
9. Export-control priority list for reconstitution inputs, on the model of the list used for Russia	M4	Table 4, military-industrial reconstitution; Box 2, imported inputs	Cost and delay of rebuilding rise	Transshipment through third countries; enforcement capacity	[111]
10. Multiyear procurement and Defense Production Act authority	M5	Table 5, munitions (L3)	Production increase is insulated from annual budgets	The limit is physical: seeker output, not legal authority	[26, 29, 30]
11. Enforcement against buyers and carriers of Russian crude, after transit is secured	M3	Table 2, Russia row	Net gain becomes net loss	Applied before M1 it raises prices for partners; the policy choice has not been made	[60, 67]
Military					
12. Low-cost counter-drone effectors; high-end interceptors reserved for ballistic threats	M5	Table 5, munitions (L3)	Interceptor consumption falls	Ballistic threats still require high-end interceptors	[103, 3]
13. Allied co-production and second sources for interceptor components	M5	Table 5, munitions	Replenishment rate rises	Years to qualify a second source; seeker output is the stated limit	[27, 30]
14. Low-cost strike options for conditional re-strike	R1	Table 3, R1; Table 1, cruise-missile replacement	Cost of R1 falls; standoff stocks preserved	Not a substitute against hardened targets	[77]
15. Allied mine countermeasures and escorts	M1, M2	Table 2, U.S. row; Table 5, fiscal	U.S. share of the escort mission falls	Domestic law and politics in each partner	[106, 107]

Instrument	Meas.	Ledger entry changed	Direction	Principal constraint	Source
16. Hardening and rapid repair of bypass infrastructure	M1	Table 2, partners row; Table 2b	Each attack on export routes moves prices less	Fixed infrastructure remains targetable; repair capacity is finite	[90, 91, 19]
Resources and supply interdiction					
17. Closing the Caspian and land-border routes that a naval blockade does not reach	M4	Table 4, subsistence and military-industrial reconstitution	Overland replacement of Gulf throughput stays small	Customs and diplomatic work with neighbors who have their own interests	[51, 52]
18. Interdiction of military inputs at the port of export, with the exporting state	M4	Table 4, military-industrial reconstitution; Box 2, imported inputs	Fewer inputs reach Iran; less friction than interdiction at sea	Requires cooperation from the exporting state or its port operators	Author judgment
19. Strategic Petroleum Reserve refill on a published schedule	M1	Table 5, energy	Reserve against a second shock is restored	Refilling into a tight market raises prices; loaned barrels are due back by September 2028	[19, 21]
20. Expanded U.S. export capacity; backfill of partner shortages in fertilizer, helium, and LNG	M1, M2	Table 2, partners row; Box 1, channel 7	Partner non-price costs fall	Capacity takes years; terminals near maximum utilization	[17, 11]
21. Securing U.S. supply of critical minerals with military uses (gallium, germanium, antimony)	M5	Table 5, munitions	Production increase is protected from a supply cutoff	Multi-year build-out. China's suspension of its export ban runs to 27 November 2026 and military-use restrictions remain	[112, 113]

Author note and disclosure

This is an open-source assessment. It uses no classified information, Controlled Unclassified Information (CUI), export-controlled technical data, or proprietary information. A large language model was used for source retrieval verification under the author's direction and for production checks; all sources were retrieved between 19 and 21 September 2026 and each quantitative claim is listed in Annex B with its source and tier. Earlier drafts received two rounds of source-verification review and one external

critique. No client is a government or state-owned entity, and no client is an energy producer. No one, including any client, commissioned or paid for this paper.

References

- [1] Donnelly, J. M. 'Pentagon's latest Iran war cost estimate: \$43.6 billion.' CQ Roll Call, 18 Sept 2026.
<https://rollcall.com/2026/09/18/pentagons-latest-iran-war-cost-estimate-43-6-billion/>
- [2] Grayer, A., and Fox, L. 'Iran war has cost \$45.1 billion, Pentagon tells Congress.' CNN, 18 Sept 2026.
<https://www.cnn.com/2026/09/18/politics/us-iran-war-cost>
- [3] 'Iran war has cost Pentagon \$38 billion, CBO estimates.' CNBC, 15 Sept 2026 (reports CBO estimate, DoD IG findings, and the DoD Inspector General's breakdown through 30 June).
<https://www.cnbc.com/2026/09/15/cbo-iran-war-cost-pentagon-weapons.html>
- [4] 'Pentagon estimates Iran war cost \$11.3B in the first six days in closed-door congressional hearing: report.' Fox News, March 2026. <https://www.foxnews.com/politics/pentagon-estimates-iran-war-cost-11-3-billion-first-six-days-closed-door-congressional-briefing-report.amp>
- [5] 'Iran war has cost Pentagon at least \$45.1 billion.' UPI, 19 Sept 2026.
https://www.upi.com/Top_News/US/2026/09/19/iran-war-costs-defense/3021789863312/
- [6] 'Estimated Iranian economic damage from war approaches \$150 billion.' Washington Examiner, 13 May 2026 (reports the FDD Center on Economic and Financial Power estimate).
<https://www.washingtonexaminer.com/news/world/4560683/estimated-iranian-economic-damage-war-cost/>
- [7] 'Iran's economic catastrophe.' fdd.org analysis, 26 June 2026 (secondary summary of the FDD CEFP estimate, its range, and frozen-asset figures). <https://www.fdd.org/analysis/2026/06/26/irans-economic-catastrophe/>
- [8] 'Cost of peace: Global economy missing out on \$2.2 trillion due to US-Iran war.' The National, 9 June 2026 (reports Institute for Economics and Peace, Global Peace Index 2026).
<https://www.thenationalnews.com/business/economy/2026/06/09/cost-of-peace-global-economy-missing-out-on-22-trillion-due-to-us-iran-war/>
- [9] Institute for Economics and Peace. 'The hidden price of the Iran war.' Vision of Humanity, 11 June 2026.
<https://www.visionofhumanity.org/the-hidden-price-of-the-iran-war/>
- [10] 'Iran's economy in charts: Hyperinflation and depreciating rial.' CNBC, 23 Apr 2026 (reports IMF World Economic Outlook figures). <https://www.cnbc.com/2026/04/23/iran-economy-war-charts-rial-oil-strait-hormuz-blockade.html>
- [11] 'Here's how much the Iran war cost -- and how its effects will linger.' NPR, 17 June 2026.
<https://www.npr.org/2026/06/17/nx-sl-5860739/iran-war-cost-oil-military-trade>
- [12] U.S. Energy Information Administration. 'China's crude oil imports fell in the second quarter.' Today in Energy, 31 July 2026. <https://www.eia.gov/todayinenergy/detail.php?id=67905>
- [13] 'Analysis: China's Oil Import Slump Points to a Deeper Demand Reset.' Caixin Global, 17 July 2026.
<https://www.caixinglobal.com/2026-07-17/analysis-chinas-oil-import-slump-points-to-a-deeper-demand-reset-102464954.html>
- [14] 'China's Crude Imports Plunge to Lowest in Nearly a Decade.' Bloomberg via Energy Connects, 15 July 2026. <https://www.energyconnects.com/news/oil/2026/july/china-s-crude-imports-plunge-to-lowest-in-nearly-a-decade/>
- [15] Institute for Energy Research. 'New EIA Report Shows Extent of Hormuz Oil Disruptions,' 22 May 2026 (summarizes EIA Global Energy Security Data report).
<https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/new-eia-report-shows-extent-of-hormuz-oil-disruptions/>

- [16] U.S. Energy Information Administration. 'U.S. exports of crude oil and petroleum products reached record in April.' Today in Energy, 8 July 2026. <https://www.eia.gov/todayinenergy/detail.php?id=67825>
- [17] U.S. Energy Information Administration. Short-Term Energy Outlook, Natural Gas, April 2026. <https://eia.gov/outlooks/steo/report/natgas.php>
- [18] U.S. Energy Information Administration. Press release, 7 July 2026 (July STEO). <https://www.eia.gov/pressroom/releases/press590.php>
- [19] 'U.S. Strategic Petroleum Reserve hits lowest level since 1982.' Quartz, 15 Sept 2026 (EIA weekly data). <https://qz.com/us-strategic-petroleum-reserve-lowest-level-1982-091526>
- [20] 'Oil Stocks in US Strategic Petroleum Reserve Fall to Lowest Level Since 1982.' EnergyNow, Sept 2026. <https://energynow.com/2026/09/oil-stocks-in-us-strategic-petroleum-reserve-fall-to-lowest-level-since-1982/>
- [21] Carter, D., and Brusuelas, J. 'Market Minute: U.S. Strategic Petroleum Reserve continues to drop.' RSM Real Economy Blog, 10 Sept 2026. <https://realeconomy.rsmus.com/market-minute-u-s-strategic-petroleum-reserve-continues-to-drop/>
- [22] 'US military claims Strait of Hormuz remains open amid ongoing blockade.' Al Jazeera, 16 Sept 2026. <https://www.aljazeera.com/news/2026/9/16/us-military-claims-strait-of-hormuz-remains-open-amid-ongoing-blockade>
- [23] 'US, Iran engaged in tanker war: Where is the months-long conflict headed?' Al Jazeera, 6 Sept 2026. <https://www.aljazeera.com/news/2026/9/6/us-iran-engaged-in-tanker-war-where-is-the-months-long-conflict-headed>
- [24] U.S. Central Command, statement of Adm. Brad Cooper, 19 Sept 2026, as reported: <https://redstate.com/nick-arama/2026/09/19/centcom-update-on-strait-n2207142> (CENTCOM published the statement on X; no press release was located).
- [25] '2026 United States naval blockade of Iran.' Wikipedia, accessed 20 Sept 2026 (used for dates only). https://en.wikipedia.org/wiki/2026_United_States_naval_blockade_of_Iran
- [26] Lockheed Martin. 'Lockheed Martin and U.S. Government Reach Historic Deal to Turbo-Charge PAC-3 MSE Production,' Jan 2026. <https://www.lockheedmartin.com/en-us/news/features/2026/Lockheed-Martin-and-U-S-Government-Reach-Historic-Deal-to-Turbo-Charge-PAC-3-Missile-Segment-Enhancement-MSE-Production-for-U-S-and-Allies.html>
- [27] 'Pentagon, Boeing agree to triple PAC-3 seeker production.' Defense News, 1 Apr 2026. <https://www.defensenews.com/industry/techwatch/2026/04/01/pentagon-boeing-agree-to-triple-pac-3-seeker-production/>
- [28] Ballinger Fletcher, Z. 'Pentagon Seeks To Accelerate Missile Production With New Agreements.' Forbes, 31 Aug 2026. <https://www.forbes.com/sites/zitaballingerfletcher/2026/08/31/pentagon-seeks-to-accelerate-missile-production-with-new-agreements/>
- [29] 'Lockheed Martin Secures \$58.6 Billion Deal For PAC-3 MSE Interceptor Production.' The Defense Watch, 30 July 2026 (includes CSIS inventory estimates). <https://thedefensewatch.com/defense-contracts/lockheed-martin-pac-3-mse-58-6-billion-multiyear-contract/>
- [30] 'PAC-3 Motor Cases, Seeker Housings Secured; Framework Web Complete, NDAA Gate Still Closed.' Tech Times, 1 Sept 2026. <https://www.techtimes.com/articles/326239/20260901/pac-3-motor-cases-seeker-housings-secured-framework-web-complete-ndaa-gate-still-closed.htm>
- [31] 'Pentagon brass tout destruction of Iran's drone arsenal, but questions linger about what's left.' DefenseScoop, 8 Apr 2026. <https://defensescoop.com/2026/04/08/hegseth-gen-caine-iran-drone-arsenal-damage-operation-epic-fury/>
- [32] 'US and Iran agree to two-week truce after Trump pulls back on threats.' Euronews, 8 Apr 2026. <https://euronews.com/2026/04/08/us-and-iran-agree-to-two-week-truce-after-trump-pulls-back-on-threats>

- [33] 'Operation Epic Fury Destroyed 80 to 90 Percent of Iran's Weapons Factories..., Pentagon Says.' Washington Free Beacon, 8 Apr 2026 (press-conference figures: 13,000 targets, 38 days). <https://freebeacon.com/national-security/americas-retribution-operation-epic-fury-destroyed-80-to-90-percent-of-irans-weapons-factories-air-defenses-naval-fleet-and-nuclear-infrastructure-pentagon-say/>
- [34] 'Exclusive: US intelligence assesses Iran maintains significant missile launching capability, sources say.' CNN, 2 Apr 2026. <https://www.cnn.com/2026/04/02/politics/iran-missiles-us-military-strikes-trump>
- [35] '2026 Iran war.' Encyclopaedia Britannica, accessed 20 Sept 2026. <https://www.britannica.com/event/2026-Iran-war>
- [36] George, M., et al. 'Trends in International Arms Transfers, 2025.' SIPRI Fact Sheet, March 2026. https://www.sipri.org/sites/default/files/2026-03/fs_2603_at_2025.pdf
- [37] DeYoung, K., Schmidt, S., and Faiola, A. 'U.S. allows Russian oil tanker to reach Cuba, break Trump's blockade.' Washington Post, 30 Mar 2026. <https://www.washingtonpost.com/world/2026/03/29/russian-tanker-cuba-anatoly-kolodkin/>
- [38] '2026 United States fuel blockade on Cuba.' Wikipedia, accessed 20 Sept 2026. https://en.wikipedia.org/wiki/2026_United_States_fuel_blockade_on_Cuba
- [39] 'Maduro's arrest shakes China's interests in Venezuela.' IDN Financials, Jan 2026 (cites Vortexa and Reuters). <https://www.idnfinancials.com/news/60191/maduros-arrest-shakes-chinas-interests-in-venezuela?page=all>
- [40] Gurol-Haller, J., and Renzullo, J. GIGA Insights, 8 Jan 2026. <https://www.giga-hamburg.de/press/maduro-venezuela-china-geopolitics>
- [41] National Bureau of Statistics of China. 'Consumer Price Index in August 2026,' 10 Sept 2026. https://www.stats.gov.cn/english/PressRelease/202609/t20260910_1965275.html
- [42] 'September Becomes Critical Juncture! JPMorgan: Crude Oil Inventories to Approach Limits.' Futu News, 1 May 2026 (secondary report of a JPMorgan Commodities Research note, 30 Apr 2026). <https://news.futunn.com/en/post/72437505/september-becomes-critical-juncture-jpmorgan-crude-oil-inventories-to-approach>
- [43] 'Is Iran's oil storage nearly full -- and will it have to cut production?' Al Jazeera, 29 Apr 2026. <https://www.aljazeera.com/economy/2026/4/29/is-irans-oil-storage-nearly-full-and-will-it-have-to-cut-production>
- [44] 'Iran cuts oil output as US blockade strains storage - BBG.' Iran International, 2 May 2026 (summarizes Bloomberg reporting). <https://www.iranintl.com/en/202605029994>
- [45] Center on Global Energy Policy, Columbia SIPA. 'Iran Crude Oil Storage Levels Are Rising, but Production Shut-ins May Not Be Imminent,' 28 Apr 2026. <https://www.energypolicy.columbia.edu/iran-crude-oil-storage-levels-are-rising-but-production-shut-ins-may-not-be-imminent/>
- [46] Iran Open Data. 'Iran's Foreign Reserves Cover One Year of Imports as Oil Exports Collapse,' 2026 (uses OPEC, CBI, and Kpler data). <https://iranopendata.org/en/article/328-Iran-Foreign-Reserves-Imports-Oil-Exports/>
- [47] Capital Economics. 'How long can Iran hold out?' Middle East and North Africa Economics Update, 29 Apr 2026 (summary only; full note is paywalled). <https://www.capitaleconomics.com/publications/middle-east-north-africa-economics-update/how-long-can-iran-hold-out>
- [48] 'Iran's Economy May Outlast Trump's Presidency.' Foreign Policy, 25 Aug 2026. <https://foreignpolicy.com/2026/08/25/iran-war-trump-sanctions-economy-collapse/>
- [49] 'Iran trade falls as sanctions pressure economy.' CNBC, 29 Aug 2026. <https://www.cnbc.com/2026/08/29/iran-trade-sanctions-dollar-oil-exports.html>

- [50] Reuters reporting of 3 Sept 2026 on Iranian officials' account of gasoline stocks, as relayed by Breitbart News, 4 Sept 2026. <https://www.breitbart.com/politics/2026/09/04/iran-down-two-months-fuel-u-s-blockade-chokes-export-lifeline/>
- [51] 'How long can Iran's war-devastated economy defy the Hormuz blockade?' Arab News, 21 Apr 2026. <https://www.arabnews.com/node/2640654/middle-east>
- [52] Steptoe. 'How Iran's Wartime Economy Works, and How Long it Can Last.' Stepwise Risk Outlook, Sept 2026. <https://www.step toe.com/en/news-publications/stepwise-risk-outlook/how-irans-wartime-economy-works-and-how-long-it-can-last.html>
- [53] 'Iran building up defenses of Kharg Island to protect against potential US ground attack, sources say.' CNN, 26 Mar 2026. <https://www.cnn.com/2026/03/25/politics/iran-kharg-island-us-military-ground-troops>
- [54] Finley, B., and Metz, S. 'Seizing Kharg Island would risk US troops and may not end Iran war, experts say.' Associated Press via Times of Israel, 31 Mar 2026. <https://www.timesofisrael.com/seizing-kharg-island-would-risk-us-troops-and-may-not-end-iran-war-experts-say/>
- [55] 'Trump mulls risky Kharg Island takeover to force Iran to open strait.' Axios, 20 Mar 2026. <https://www.axios.com/2026/03/20/iran-invasion-kharg-island-strait-hormuz>
- [56] Council on Foreign Relations. 'Kharg Island: Iran's Oil Lifeline and a Tempting U.S. Target,' updated 11 June 2026. <https://www.cfr.org/articles/kharg-island-irans-oil-lifeline-and-a-tempting-u-s-target>
- [57] 'Iran's defense-industrial base completely destroyed: Pentagon chief.' AFP via A News, 8 Apr 2026. <https://www.aneews.com.tr/world/2026/04/08/irans-defense-industrial-base-completely-destroyed-pentagon-chief>
- [58] 'How Iran's massive arsenal of missiles and drones became its last line of defense.' Arab News, March 2026 (reports activation of the 'Decentralized Mosaic Defense' strategy). <https://www.arabnews.com/node/2635534/amp>
- [59] 'Iran's Kharg Island Oil Shipments Show First Prolonged Halt Since Start of War.' Bloomberg via Yahoo Finance, 12 May 2026. <https://finance.yahoo.com/sectors/energy/articles/iran-kharg-island-oil-shipments-174555890.html>
- [60] 'Russia in the 2026 Iran war.' Wikipedia, accessed 20 Sept 2026 (relays Reuters calculations of mineral extraction tax receipts and Centre for Research on Energy and Clean Air export data). https://en.wikipedia.org/wiki/Russia_in_the_2026_Iran_war
- [61] U.S. Energy Information Administration. WTI Cushing spot price, daily series: \$92.55 on 3 Sept 2026; \$64.36 one year earlier. Relayed by YCharts. https://ycharts.com/indicators/wti_crude_oil_wholesale_spot_petroleum_price
- [62] International Monetary Fund. World Economic Outlook, April 2026: nominal GDP 2026, United States \$32.38 trillion, China \$20.85 trillion, world about \$124-126 trillion. Relayed by Statista, 14 Apr 2026. <https://www.statista.com/statistics/268173/countries-with-the-largest-gross-domestic-product-gdp/>
- [63] 'China's 2025 refinery throughput, crude and gas output hit new highs.' Reuters via Hydrocarbon Processing, Jan 2026 (NBS data: runs 14.75 mb/d; crude output 4.32 mb/d). <https://hydrocarbonprocessing.com/news/2026/01/chinas-2025-refinery-throughput-crude-and-gas-output-hit-new-highs/>
- [64] 'Factbox: Russia's growing energy ties with China since the Ukraine war.' Reuters, 1 Sept 2025 (2024 customs: 108.5 Mt, 2.17 mb/d; ESPO spur 30 Mt per year). <https://wimz.com/2025/09/01/factbox-russias-growing-energy-ties-with-china-since-the-ukraine-war/>
- [65] S&P Global Commodity Insights. 'Russia-Ukraine conflict puts China's incremental crude appetite in spotlight,' 25 Feb 2022 (pipeline contracts: 30 Mt per year via Skovorodino-Mohe, 10 Mt per year via Atasu-Alashankou; both near capacity). <https://www.spglobal.com/commodity-insights/en/news->

- research/latest-news/crude-oil/022522-russia-ukraine-conflict-puts-chinas-incremental-crude-appetite-in-spotlight
- [66] Center for European Policy Analysis. 'A Limited Lifeline: Russia's Role in China's Energy Security,' 10 Sept 2025 (Middle East 48% of China's crude imports in 2023). <https://cepa.org/commentary/a-limited-lifeline-russias-role-in-chinas-energy-security/>
- [67] Centre for Research on Energy and Clean Air. 'July 2026: Monthly analysis of Russian fossil fuel exports and sanctions,' 13 Aug 2026. <https://energyandcleanair.org/july-2026-monthly-analysis-of-russian-fossil-fuel-exports-and-sanctions/>
- [68] RFE/RL. 'Iran's Oil Stockpiles Could Run Out by Mid-October,' 8 Sept 2026 (Kpler data as reported by the Wall Street Journal, 7 Sept; Reuters on August loadings). Via GlobalSecurity.org. <https://www.globalsecurity.org/wmd/library/news/iran/2026/09/iran-260908-rferl05.htm>
- [69] 'Iran shadow fleet tankers near Malaysia test oil sanctions blockade.' Fox News, Aug 2026 (relays Reuters and provisional Kpler data). <https://www.foxnews.com/politics/millions-barrels-iranian-oil-sit-beyond-trump-blockade-vows-zero-leakage>
- [70] 'Russia is sending upgraded drones used in the Ukraine war to Iran, officials say.' Associated Press, March 2026. <https://wtop.com/russia-ukraine-war-news/2026/03/russia-is-sending-upgraded-drones-used-in-the-ukraine-war-to-iran-officials-say/>
- [71] 'Russia is supplying Iran with Shahed drones for strikes against US and Israel, Zelenskyy says.' Euronews, 15 Mar 2026. <https://www.euronews.com/2026/03/15/russia-is-supplying-iran-with-shahed-drones-for-strikes-against-us-and-israel-zelenskyy-sa>
- [72] 'Cuba's electrical grid suffers partial collapse as protests flare.' Reuters via Chronicle.lu, 14 May 2026. <https://chronicle.lu/category/international-news/61210-cubas-electrical-grid-suffers-partial-collapse-as-protests-flare>
- [73] Duran, M. 'Islandwide blackout hits Cuba as its fuel reserve dwindles and aging grid crumbles.' Associated Press via WLRN, 6 July 2026. <https://www.wlrn.org/light/americas/2026-07-06/islandwide-blackout-hits-cuba-as-its-fuel-reserve-dwindles-and-aging-grid-crumbles>
- [74] 'Russia to send second oil tanker to Cuba as energy crisis continues, Moscow says.' Euronews, 2 Apr 2026. <https://euronews.com/2026/04/02/russia-to-send-second-oil-tanker-to-cuba-as-energy-crisis-continues-moscow-says>
- [75] George, C. B. 'Denying Chinese Victory: Cost, Resource, and Military Advantages Available to the United States.' Sanctir WP-2026, Sept 2026. SSRN Abstract ID 7490119.
- [76] Congressional Budget Office. 'Estimating the Cost of Combat Operations Against Iran.' Letter to the Hon. Brendan F. Boyle, 15 Sept 2026, publication 62756. <https://www.cbo.gov/system/files/2026-09/62756-Iran.pdf>
- [77] 'Iran war cost US \$38 billion: Congressional Budget Office.' IANS via Morung Express, 16 Sept 2026 (component breakdown of the CBO estimate). <https://morungexpress.com/iran-war-cost-us-38-billion-congressional-budget-office>
- [78] Institute for Economics and Peace. Global Peace Index 2026. Sydney, June 2026 ('Economic Impact of the Iran War,' p. 59 ff.). <https://www.visionofhumanity.org/wp-content/uploads/2026/06/Global-Peace-Index-2026-Report.pdf>
- [79] '121 commercial vessels redirected in Strait of Hormuz since start of US blockade.' Emirates News Agency (WAM), 2 June 2026 (relays a CENTCOM statement posted to X). <https://www.wam.ae/en/article/1792zzl-121-commercial-vessels-redirected-strait-hormuz>
- [80] International Energy Agency. 'Oil Stocks of IEA Countries,' methodology note. <https://www.iea.org/articles/oil-stocks-of-iea-countries>
- [81] UK Department of Energy and Climate Change. 'Emergency oil stocking: international obligations,' policy paper (IEA obligation calculated with a 10 per cent exclusion for tank bottoms). <https://www.gov.uk/government/publications/uk-emergency-oil-stocking-international-obligations>

- [82] 'Asia in the crosshairs: Strait of Hormuz chokehold threatens energy lifeline.' AFP via Malay Mail, 24 June 2025 (reporting EIA chokepoint data: China the largest Hormuz destination, about 5.4 mb/d of crude in Q1 2025; the figure is China's slice of EIA's flow data, not a headline EIA statistic). <https://malaymail.com/news/world/2025/06/24/asia-in-the-crosshairs-strait-of-hormuz-chokehold-threatens-energy-lifeline-for-china-india-japan/181477>
- [83] 'China's crude import stress resistance in a Hormuz crisis.' Vortexa analysis via Hellenic Shipping News, March 2026 (Hormuz share: 51% of seaborne imports and about 35% of total crude supply in 2025). <https://www.hellenicshippingnews.com/chinas-crude-import-stress-resistance-in-a-hormuz-crisis/>
- [84] 'How exposed is China to the Hormuz crisis?' bne IntelliNews, 2026 (2025 customs data by supplier; Malaysian-labelled volumes largely redirected Iranian crude). <https://www.intellinews.com/how-exposed-is-china-to-the-hormuz-crisis-429219/>
- [85] Institute for the Study of War and Critical Threats Project. 'Russian Offensive Campaign Assessment, September 10, 2026' (strikes at Novy Urengoy and Purovsky, about 2,840 and 2,780 km from the Ukrainian border). <https://www.criticalthreats.org/analysis/russian-offensive-campaign-assessment-september-10-2026>
- [86] 'How Ukraine's deepest attack in Russia, on Arctic gas, signals new reach.' Al Jazeera, 10 Sept 2026 (previous record: Omsk refinery, about 2,500 km, July 2026). <https://www.aljazeera.com/news/2026/9/10/how-ukraines-deepest-attack-in-russia-on-arctic-gas-signals-new-reach>
- [87] International Monetary Fund. World Economic Outlook database, GDP at current prices, Islamic Republic of Iran: April 2025 edition (\$361 billion, pre-war) and April 2026 edition (\$300 billion for 2026; relayed by Worldometer as \$300.29 billion). <https://www.imf.org/external/datamapper/NGDPD@WEO/OEMDC/ADVEC/WEOWORLD/IRN>
- [88] U.S. Energy Information Administration. 'Iran's crude oil production fell to an almost 40-year low in 2020.' Today in Energy, 12 Aug 2021 (crude and condensate exports: more than 2.5 mb/d in 2017; below 0.4 mb/d average in 2020). <https://www.eia.gov/todayinenergy/detail.php?id=49116>
- [89] S&P Global Commodity Insights. 'Iran vows to fight Donald Trump's max pressure to slash its oil exports,' 9 Feb 2025 (Commodities at Sea data: 2.8 mb/d in April 2018; about 260,000 b/d in Sept 2019; 1.8 mb/d in Sept 2024). <https://spglobal.com/commodity-insights/en/news-research/latest-news/crude-oil/020925-iran-vows-to-fight-donald-trumps-max-pressure-to-slash-its-oil-exports>
- [90] U.S. Energy Information Administration. Today in Energy, item 65504 (Strait of Hormuz chokepoint analysis: East-West pipeline 5 mb/d, temporarily 7 mb/d; UAE pipeline 1.8 mb/d; about 2.6 mb/d of bypass capacity available). <https://www.eia.gov/todayinenergy/detail.php?id=65504>
- [91] 'UAE to accelerate oil pipeline project to help bypass Hormuz.' Reuters via Aaj English, 15 May 2026 (Aramco chief executive: East-West capacity raised to 7 mb/d; ADCOP up to 1.8 mb/d). <https://english.aaj.tv/news/amp/330459029>
- [92] 'UAE to accelerate oil pipeline project to bypass Strait of Hormuz.' Al Jazeera, 15 May 2026. <https://www.aljazeera.com/amp/news/2026/5/15/uae-to-accelerate-oil-pipeline-project-to-bypass-hormuz>
- [93] U.S. Energy Information Administration. 'How much oil is consumed in the United States?' Frequently Asked Questions (2025: about 20.6 million barrels a day). <https://www.eia.gov/tools/faqs/faq.php?id=33&t=6>
- [94] U.S. General Accounting Office. Persian Gulf: Allied Burden Sharing Efforts. GAO/NSIAD-92-71, 30 Dec 1991 (about \$54 billion pledged; about \$50.5 billion received by 15 Nov 1991). Summary at https://www.legistorm.com/reports/view/gao/21123/Allied_Burden_Sharing_Efforts.html
- [95] 'Gulf war estimate: \$61 billion.' UPI, 1 Aug 1991. <https://www.upi.com/Archives/1991/08/01/Gulf-war-estimate-61-billion/4665681019200/>

- [96] Duelfer, C. Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD. Central Intelligence Agency, 30 Sept 2004.
- [97] Kerr, P. 'Duelfer Disproves U.S. WMD Claims.' Arms Control Today, Nov 2004. <https://www.armscontrol.org/act/2004-11/duelfer-disproves-us-wmd-claims>
- [98] 'US: Iraq was free of WMDs.' Al Jazeera, 6 Oct 2004 (Duelfer testimony on the weakening of sanctions by 2000-2001). <https://www.aljazeera.com/news/2004/10/6/us-iraq-was-free-of-wmds>
- [99] Davis, S. J., Murphy, K. M., and Topel, R. H. 'War in Iraq versus Containment.' NBER Working Paper 12092, March 2006. <https://www.nber.org/papers/w12092>
- [100] The White House. National Security Strategy of the United States of America. Dec 2025. <https://www.whitehouse.gov/wp-content/uploads/2025/12/2025-National-Security-Strategy.pdf>
- [101] Japan Institute of International Affairs. 'Trump 2.0's Vision for the Western Hemisphere,' Jan 2026 (quotes the Western Hemisphere section of the strategy). <https://www.jiia.or.jp/eng/report/2026/01/us-2026-01.html>
- [102] Brownstein Hyatt Farber Schreck. 'White House Releases 2025 National Security Strategy,' Dec 2025 (summary: burden sharing; Middle East chokepoints). <https://www.bhfs.com/insight/white-house-releases-2025-national-security-strategy/>
- [103] 'Counter-UAS: The Price of the Shot.' Inside Unmanned Systems, 2026 (Gen. David Allvin: guided rocket about \$35,000 a round; AMRAAM about \$1 million). <https://insideunmannedsystems.com/counter-uas-the-price-of-the-shot/>
- [104] Center for the Study of Intelligence, Central Intelligence Agency. 'Fighting Iran: Intelligence Support During Operation Earnest Will, 1987-88.' Studies in Intelligence. <https://www.cia.gov/resources/csi/static/Fighting-Iran.pdf>
- [105] U.S. Naval War College paper on Operation Earnest Will, Defense Technical Information Center ADA293686 (127 escort missions by the end of the operation). <https://apps.dtic.mil/sti/pdfs/ADA293686.pdf>
- [106] 'Japan hesitant to clear mines in Strait of Hormuz, fearing next flare-up.' The Yomiuri Shimibun via Asia News Network, 17 June 2026 (joint statement by Britain, France, Germany, and Italy on navigation and mine clearance; Japan to sign; Japanese law permits clearance only after fighting ends; 1991 precedent). <https://asianews.network/japan-hesitant-to-clear-mines-in-strait-of-hormuz-fearing-next-flare-up/>
- [107] Arab Gulf States Institute. 'Sea Mines in Hormuz: Deciphering the U.S. Mine-Clearing Delay,' 2026 (1991: U.S.-U.K. and European task forces with Japan; 28 vessels at peak; nearly 1,300 mines cleared). <https://agsi.org/analysis/sea-mines-in-hormuz-deciphering-the-u-s-mine-clearing-delay/>
- [108] U.S. Department of the Treasury. 'United States and Switzerland Finalize the Swiss Humanitarian Trade Arrangement.' Press release sm919, 27 Feb 2020. <https://home.treasury.gov/news/press-releases/sm919>
- [109] International Institute of Humanitarian Law. San Remo Manual on International Law Applicable to Armed Conflicts at Sea, 12 June 1994, paragraphs 93-104 (blockade).
- [110] Medecins Sans Frontieres. 'Blockade.' The Practical Guide to Humanitarian Law (summary of the San Remo provisions: declaration, effectiveness, impartiality, humanitarian passage). <https://guide-humanitarian-law.org/content/article/3/blockade/>
- [111] U.S. Department of Commerce, Bureau of Industry and Security. 'Common High Priority List,' 23 Feb 2024 (50 items by six-digit HS code, in four tiers, developed with the European Union, Japan, and the United Kingdom). <https://www.bis.gov/licensing/country-guidance/common-high-priority-items-list-chpl>
- [112] Kurtenbach, E. 'China bans exports to U.S. of key high-tech materials in response to chip sanctions.' Associated Press via PBS NewsHour, 3 Dec 2024. <https://www.pbs.org/newshour/world/china-bans-exports-to-u-s-of-key-high-tech-materials-in-response-to-chip-sanctions>

- [113] 'China lifts export ban on gallium, germanium and antimony to US.' The Northern Miner, Nov 2025 (suspension runs to 27 Nov 2026; licence requirements and restrictions on trade for military use remain). <https://www.northernminer.com/news/china-lifts-export-ban-on-gallium-germanium-and-antimony-to-us/1003884442/>
- [114] Schelling, T. C. Arms and Influence. New Haven: Yale University Press, 1966.
- [115] Pape, R. A. 'Why Economic Sanctions Do Not Work.' International Security 22, no. 2 (Fall 1997): 90-136.
- [116] Hufbauer, G. C., Schott, J. J., Elliott, K. A., and Oegg, B. Economic Sanctions Reconsidered, 3rd ed. Washington, DC: Peterson Institute for International Economics, 2007.
- [117] Marshall, A. W. Long-Term Competition with the Soviets: A Framework for Strategic Analysis. RAND R-862-PR, 1972.
- [118] Mahnken, T. G., ed. Competitive Strategies for the 21st Century: Theory, History, and Practice. Stanford: Stanford University Press, 2012.
- [119] Farrell, H., and Newman, A. L. 'Weaponized Interdependence: How Global Economic Networks Shape State Coercion.' International Security 44, no. 1 (Summer 2019): 42-79.
- [120] Mulder, N. The Economic Weapon: The Rise of Sanctions as a Tool of Modern War. New Haven: Yale University Press, 2022.