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Actual Economics on the Recognition Ledger

Shape-of-Reality Forcing, the Four-Way Actuals Partition, Seven-Law Core Mounting, Seven-Rival Exclusion, and Pre-Registered Blind Verdict Boundaries

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Abstract

If economics is objective physical structure on the recognition ledger rather than an axiom system chosen for convenience, what must a rival economics get physically wrong—and what must remain genuinely free as human choice or accounting convention? Leaving the candidate economic law $L : Q \to \{0, 1\}$ completely unknown at the outset, we mount *Actual Economics* directly on the exact same seven-law physical ledger core (C_1–C_7) that mounts *The Physical Moral Code of Reality*, under the forcing architecture of *The Actuals*.

First, instantiating the signed-graph determination theorems of *The Actuals* with zero prior commitment to any economic rule proves an exact **Four-Way Economic Partition**: **Law** (seven core economic invariants uniquely determined and necessary across realizations, with constructive zero-axiom disagreement witnesses and proposed-code identification), **Choice** (point prices inside the voluntary Edgeworth band, agreed credit rates, legal form, and voluntary written partial release versus consideration—each proved unreached with two opposite compatible laws), **Gauge** (currency unit scale, display sign, and port labelling—unanchored individually, relatively tied, and invariant under basis equivalences and port-preserving twins), and **History** (run-local facts realized with opposite answers across concrete valid ledger runs). Every economic case is faithfully fixed by the five independent parts of a recognition act (`term`, `comparison`, `record`, `locus`, `order`).

Second, three structural pillars mount on C_1–C_7 with zero verdict words in any physical carrier (0/35 banned terms under kernel encoding scan): (I) located physical stock conservation, the unique unit-free open floor 0 (forcing any positive floor to be a dated reserve undertaking), four-live-resource quotient minimality with permanent historical retention, and proof that matched books can never mint physical stock; (II) exact zero-sum net claims, cut-space clearing and $\cosh t - 1$ exact settlement, equivalence of triangular no-arbitrage and zero round-trip comparison cost $J(R_{ij}R_{jk}R_{ki}) = 0$, currency gauge neutrality, zero native carrying cost on agreed credit versus strictly positive per-tick cost $N \cdot J(a/b) > 0$ on standing disagreement, and conserved-genealogy Zipf tail exponent 1 (not φ);

(III) single-charged coalition burden with a concrete member-ruin obstruction against aggregate-only rules, clean separation of member unions from dedicated corporate ports (resolving reflective loss and dissolution succession without post-death continuation), and full formalization of all three multi-party commercial seams inherited from the moral-code blind test (assignment with notice, private third-party duress versus an innocent relying bank, and voluntary partial release versus consideration).

Third, all seven major economic rivals (R-E1–R-E7) are disposed of directly in Lean 4 alongside six literal `CoreV1` broken-world ghost certificates and three gauge twins. The single physical identification (E-ID: economic position is located physical stock coupled to core crossing departures and J-cost) passes Rule R's three-domino restatement test and six anti-rubber-stamping trap fixtures inside a zero-axiom kernel status view, certified jointly with *The Physical Moral Code of Reality* on one single core witness.

Fourth, we hold the mounted theory to strictly pre-registered blind accountability and report **misses first**. Across 26 anonymized commercial, accounting, clearing, FX, corporate, and scarcity disputes (91 questions; rules, rubric, and predictions locked read-only with verified SHA-256 digests prior to unsealing), the frozen engine records **2 unpatched mechanical lookup misses** (`EB-02-Q3` and `EB-11-Q1`, both classified as `Q_ENCODING_ERROR` and left unedited in the locked engine), **0** core-law defects, **0** attachment-boundary real misses, **86/88 (**97.7%**)** uncontested passes (30/30 Suite A, 31/33 Suite B, 25/25 Suite C; $23/25 = 92.0\%$ on the 8 novel compound `E2-Stripped` cases), and **3/3** contested matches on the statutory-release versus consideration boundary (`EB-06`). Two historical empirical refusals remain permanently on the append-only miss register: `ECON-MISS-01` (SWIFT gpi mean 0.829 observed against an unforced φ-geometric guess of 1.618, mathematically superseded by the conserved-partition Zipf exponent 1) and inherited `MORAL-MISS-01` (55,422 human biological records). Informal real-world signal decoding and macro tail calibration remain explicit named open propositions. All formal results are machine-checked in Lean 4 across 9 library modules and 1 audit file (7,737 lines, 495 declarations, 246 public theorems, 111 audited declarations: 26 zero-axiom, 14 choice-free, 71 standard axioms, zero `sorry`, zero warnings).

1 Introduction: What Must a Rival Economics Get Physically Wrong?

Economics usually begins by choosing axioms: preferences, utility functions, price-taking markets, budget sets, or social welfare functionals [6, 7]. Because those axioms are selected for tractability, two rival schools can disagree over whether aggregate output outweighs a member's ruin, whether bookkeeping entries create consumable wealth, whether unilateral circular set-off cancels bilateral obligations, whether interest is a natural carrying cost of open credit, or whether corporate dissolution extinguishes an acknowledged receivable—and neither side can point to a physical law the other breaks.

Recognition Science asks the inverse question, framed by the determination blueprint of *The Actuals* [1]: *leave the candidate economic law $L : Q \to \{0, 1\}$ completely unknown at the start.* Take the already-derived physical ledger architecture—permanent ordered records (C_1), reciprocal double-entry crossings (C_2), the forced even comparison cost $J(x) = \frac{1}{2}(x + 1/x) - 1$ (C_3), disjoint port independence (C_4), uniform continuous comparison ratio φ (C_5), least-cost histories (C_6), and register binding (C_7)—couple it to located physical stocks, and ask:

(1) Which economic propositions are **physically forced** across every admissible realization of the ledger, so that any disagreeing rival must explicitly break a named physical fact?

(2) Which economic questions are **genuinely free** as human or institutional *Choice* (such as where a voluntary trade clears inside an Edgeworth band, what interest rate two parties write into a contract, whether they form a partnership or a corporation, or whether a jurisdiction enforces an unbargained written debt release)?

(3) Which differences are pure **Gauge** conventions (currency unit, display sign, port names) invisible to every physical invariant?

(4) Where does pure deduction stop, leaving explicit **open empirical and attachment boundaries** accountable to pre-registered blind tests?

Answering these four questions without inserting a single verdict primitive into any physical structure produces five interlocking results on the exact same ledger core that mounts *The Physical Moral Code of Reality* [2]:

- **The Four-Way Actuals Partition and Five-Part Act Completeness (Section 2):** Instantiating Theorems 1 and 3 and Corollaries 5 and 6 of *The Actuals* separates the economic question space rigorously into *Law*, *Choice*, *Gauge*, and *History*, while proving that the five parts of a recognition act (`term`, `comparison`, `record`, `locus`, `order`) are jointly complete and strictly independent on both protocol runs and economic acts.
- **Pillar I—Physical Stocks, Unit-Free Floor 0, and Four-Live-Resource Minimality (Section 3):** Every coupled production or transfer trace conserves total material and effort; internal production leaves every apart port untouched (C_4); external transfer writes identically into both ports' records ($C_1 + C_4$); 0 is the unique scale-invariant floor (so any positive floor is a reserve undertaking); exactly four live counts (raw, ready, stored, effort) determine future operational feasibility while historical counters (consumed, spent) stay permanently distinct on the ledger; and no function of books or crossing matrices can mint stock or decide consumption feasibility.
- **Pillar II—Zero-Sum Claims, Cut-Space Clearing, Round-Trip J-No-Arbitrage, Credit Cost, and Zipf 1 (Section 4):** Net claims sum identically to zero on every C_1–C_7 core world; exchange creates neither goods nor aggregate valued wealth; settlement depends on cut-space cycle closure and admits a unique $\cosh t - 1$ minimizer characterized by $\sinh(t^*) \in \mathrm{Grad}$; a positive reciprocal FX rate table admits a price vector if and only if every triangular round-trip carries zero J-cost; currency scale is pure gauge; agreed open credit carries strictly zero native J-cost per tick whereas standing disagreement incurs $N \cdot J(a/b) > 0$; and conserved golden binary splitting forces Zipf tail exponent 1, not φ.
- **Pillar III—Wholes, Corporate Ports, and Three Multi-Party Commercial Seams (Section 5):** Coalition burden is uniquely forced by single charging of internal bonds, yet identical aggregate cost drops can hide a member's survival ruin, refuting every aggregate-only admissibility rule. Separating a `MemberUnion` from a dedicated `CorporateEntity` port resolves reflective loss (*Prudential/Marex*) and debt-free dissolution succession (*Levy v. Liebling*) without invoking post-death continuation (`NoExit`). All three multi-party seams that caused the only real misses in the companion moral-code blind check—assignment before/after notice, private third-party duress against an innocent relying bank, and volun-

tary written partial release versus consideration—close cleanly on C_1–C_7 with zero verdict smuggling.

- **Seven-Rival Disposal, Rule R Closure, and Pre-Registered Blind Accountability (Sections 6–8):** All seven major economic rivals (R-E1–R-E7) receive machine-checked Lean 4 refutations alongside six `CoreV1` ghost certificates, three gauge twins, a zero-axiom four-axis closure kernel passing G3, G5, and traps `EG1`–`EG6`, and a strictly pre-registered 26-case (91-question) blind verdict check reported misses first alongside retired refusal `ECON-MISS-01` and inherited `MORAL-MISS-01`.

1.1 One Shared Physical History: Mara, Eli, Cal, and The Bakery

A common doubt about foundational derivations is whether ethics and economics really inhabit the *same* physical object or merely borrow the same vocabulary. To settle that question concretely before a single abstract theorem is stated, we anchor both papers in one single multi-party physical history on four pairwise apart ports Fin 4: **Mara** (port 0), **Eli** (port 1), **Cal** (port 2, bystander and commercial counterparty), and **The Bakery** (port 3, a dedicated corporate port owned by shareholders Mara and Eli).

Every episode below is written into the exact same append-only double-entry record $r \in W.\mathrm{Rec}$ of a seven-law physical ledger world W coupled to located physical stocks $\mathrm{stock} : W.\mathrm{Port} \to \mathrm{Stock}$:

E1. Physical stock and production at Mara's port: Mara starts with 1 unit of raw grain (carrying 2 material units) and 1 unit of baking effort, and zero ready loaves: $\mathrm{stock}(\mathrm{Mara}) = (1, 0, 0, 0, 1, 0)$. She runs an internal `produce` operation, turning (1 raw, 1 effort) into (2 ready loaves, 1 spent effort) while conserving total material ($2 = 2$) and effort budget ($1 = 1$). No book entry between Mara and Eli can create a third loaf, and Mara's internal baking leaves Eli's, Cal's, and The Bakery's restricted records completely untouched (C_4).

E2. Eli's dated food undertaking to Mara (the shared Mara–Eli seam): Just as in *The Physical Moral Code of Reality* [2, §4], Mara redirects her effort into a service relying on Eli's dated undertaking to deliver 1 loaf by tick 1. At tick 2, Eli remains physically able either to deliver or to walk away. Conservation of completed transfers never forces future performance; instead, the retained undertaking opens a dated crossing departure between Eli and Mara while leaving Cal completely clear.

E3. Agreed zero-interest credit line versus standing disagreement: Mara delivers 1 ready loaf to Eli on an agreed 10-tick zero-interest open credit line, both books recording 100 units. Because both ends agree on the ratio $100/100 = 1$, the open credit incurs $10 \cdot J(1) = 0$ native recognition cost per tick. By contrast, if Eli later claims only 80 is owed while Mara's record holds 100, the mismatched open claim accumulates strictly positive carrying strain $N \cdot J(100/80) = N \cdot \frac{1}{40} > 0$ at every tick $N \geq 1$.

E4. Three-party circular claim loop (Mara → Eli → Cal → Mara): Suppose three distinct 100-unit open crossings form a directed cycle around Mara, Eli, and Cal. Every participant's personal net balance is identically $100 - 100 = 0$. Yet the three bilateral crossings are nonzero, opposite to the reverse cycle Mara → Cal → Eli → Mara, and neither Eli nor Cal can unilaterally erase Mara's claim in a single event without violating

Episode on Fin 4	Shared ledger object (C_1–C_7)	Reading in *Moral Code* [2]	Reading in *Actual Economics*
E1. Mara bakes grain	Local op inside port 0; apart ports untouched (C_4)	Boundary locality; authorship of holdings	Stock conservation ($2r+f+s+c$); books cannot mint stock
E2. Eli's dated food promise	Dated crossing spec e_{food}; Cal untouched	`.violated` on Eli, `.clear` on Cal (`AD1`–`AD3`)	Deferred delivery feasibility; conflicting-claim priority
E3. Credit line vs. mismatch	Matched 100/100 vs. mismatched 100/80 books	Faithful departure M-ID; third-record gap	0 carrying cost on agreed credit; $N \cdot J(a/b) > 0$ on gap
E4. 3-party claim loop	Cycle 0→1→2→0 with 0 net per port	T_3 Three-Party Circulation kills egoism	Refutes unilateral circular set-off (R-E3); cut-space clearing
E5. Wheat–Silver–Linen FX	Reciprocal comparison table R_{ij}	C_2 `ClosedChainsNetZero`; C_3 J-cost	No-arbitrage $\iff$ round-trip $J = 0$; $J(1/2) = \frac{1}{4}$ (R-E7)
E6. Bakery treasury taken	Crossing on (Cal, Bakery); Mara/Eli 0	Bystander isolation (C_4); single restitution	Corporate vs. member union; reflective loss separated (R-E6)
E7. Bakery dissolves (150 due)	Port 3 exits on `exitWorld`; authored transfer	Exit freezes debt (`NoExit` unused by verdicts)	`SuccessionTransfer` preserves 150 to Mara (*Levy*/`SA-02`)

Table 1. One permanent physical history across four pairwise apart ports (**Mara**, **Eli**, **Cal**, **The Bakery**) read simultaneously by *The Physical Moral Code of Reality* and *Actual Economics* on the same seven-law core witness (`UnifiedActualsStack.unified_actuals_morality_economics_mounted`).

reciprocal double entry (C_2) or disjoint port locality (C_4).

E5. Three-good exchange rate table (Wheat–Silver–Linen): Quoted pairwise exchange rates $(R_{\text{WS}}, R_{\text{SL}}, R_{\text{LW}})$ yield a coherent price vector if and only if the round-trip product equals 1, i.e. $J(R_{\text{WS}}R_{\text{SL}}R_{\text{LW}}) = 0$. A 10% market dislocation ($r = 11/10$) carries exact round-trip cost $J(11/10) = 1/220$, and a 2-to-1 quote spread ($r = 1/2$) carries exact round-trip cost $J(1/2) = 1/4 > 0$ while creating zero physical goods as an unexecuted quote.

E6. Unauthorized depletion of The Bakery's treasury: Cal executes an unauthorized 100-unit extraction out of **The Bakery**'s port (port 3). Because The Bakery is a dedicated port apart from its shareholders Mara and Eli, the crossing lands strictly on (Cal, Bakery) with magnitude 100, while both (Cal, Mara) and (Cal, Eli) remain identically 0 on the ledger. The Bakery recovers 100 once; shareholders cannot double-recover reflective loss directly.

E7. Voluntary dissolution of The Bakery with a surviving receivable: After paying every outside creditor, The Bakery holds an acknowledged 150-unit receivable against Cal and formally dissolves (ceasing all future postings at port 3). On the seven-law core, port exit never erases an open crossing: the 150-unit crossing freezes permanently on the retained record, and The Bakery's authored dissolution transfer assigns that exact 150-unit claim to Mara as successor shareholder with zero erasure and zero double-counting.

Table 1 summarizes the exact duality. Morality and economics are not two competing models stitched together by metaphor; they are two formally certified views of the exact same permanent record and physical stock state.

2 *The Actuals* Forcing Blueprint and the Four-Way Economic Partition

Before proving any economic theorem, we state the general logical machinery of *The Actuals* [1] as formalized in `ActualsDomain.lean` and `ActualsParts.lean`, and show how instantiating

it with an unknown economic law $L : Q \to \{0,1\}$ produces an exact four-way epistemic partition.

2.1 Three grades of determination and the signed-graph criterion

Following [1], three claims must never be conflated:

1. **Grade 1 (Actual):** a relation is instantiated by concrete physical objects, operations, or histories.
2. **Grade 2 (Uniquely determined):** the independently specified physical requirements of the relation's role leave exactly one compatible function $L : Q \to \{0,1\}$ across its question domain.
3. **Grade 3 (Necessary across realizations):** every admissible realization in a specified family preserves those determining facts, so one governing code $C : A \to \{0,1\}$ fixes every compatible local law across all realizations.

Let Q be a set of fully addressed binary questions. A *basis* $B = (\text{probe}, \text{cmp})$ supplies independently justified binary observations $\text{probe} \subseteq Q \times \{0,1\}$ and preserve-or-reverse structural comparisons $\text{cmp} \subseteq Q \times Q \times \{0,1\}$. A candidate law $L : Q \to \{0,1\}$ is *compatible* with B (`Compatible B L`) when $L(q) = b$ for every probe (q,b) and $L(r) = L(q) \oplus s$ for every comparison (q,r,s), where $\oplus$ denotes `carry` (addition modulo 2). Write $\text{Reached}(B,q,b)$ when some probe bit travels along a finite (possibly zero-length) undirected path of comparisons to arrive at q with bit b, and $\text{Tied}(B,q,r,s)$ when a finite comparison path links q and r with parity s.

Theorem 1 (Exact criterion, disagreement witness, transport, and identification)**.** *Let B be a basis on Q and let $F = (Q_w, B_w, a_w)_{w \in W}$ be a family of realizations with address maps $a_w : Q_w \to A$.*

(i) ***Unique determination*** *(`unique_compatible_law_iff`, Thm. 1): Exactly one compatible law $L : Q \to \{0,1\}$ exists if and only if every $q \in Q$ is reached from some probe and any two paths reaching q yield the same bit.*

(ii) ***Constructive disagreement witness*** *(`disagreement_has_witness`, `disagreement_has_witness_on_path`, Thm. 3, zero axioms): Given an explicit derivation $d : \text{Derivation}(B,q,b)$, a translation $f : Q \to Q'$, and any law L' compatible with a target basis B' such that $L'(f(q)) \neq b$, at least one probe or comparison actually traversed on d fails to hold under f in B'.*

(iii) ***Unreached freedom and tied relations*** *(`free_of_unreached`, `relation_determined`): If $\text{Compatible}(B,L)$ and q is unreached, there exists a compatible L' flipping $L(q)$ while keeping every untied question fixed. Conversely, whenever $\text{Tied}(B,q,r,s)$ holds, every compatible law satisfies $L(q) \oplus L(r) = s$ (zero axioms).*

(iv) ***One representative suffices*** *(`one_representative_suffices`, Cor. 5, choice-free): If reference basis B_0 has unique compatible law L_0 and each realization $w \in W$ admits a basis-preserving bijection $e_w : \text{BasisEquiv}(B_w, B_0)$, then every compatible local law in every realization w equals $L_0 \circ e_w$.*

(v) ***Governing necessity and failure modes*** *(`governed_iff_necessary`, `not_necessary_cases`): When every B_w is consistent, a domain $S \subseteq A$ admits a governing code C iff every*

$a \in S$ is necessary (`Necessary F a`*). An address fails necessity iff either some realization leaves a local question at a unreached (Case 1: Choice or Gauge) or two realizations reach opposite bits at a (Case 2: History).*

(vi) ***Proposed-code identification*** *(*`identification_of_proposed_code`*, Cor. 6, zero axioms): If C governs S across F and a proposed code $M : A \to \{0,1\}$ restricts to a compatible law on every realization, then $M(a) = C(a)$ at every realized address $a \in S$.*

The axiom footprint of Theorem 1 is notable: constructive witness localization (ii), fixed tie propagation (iii), and proposed-code identification (vi) depend on **zero axioms** in Lean 4, and representative transport (iv) uses only `[Quot.sound]` (strictly choice-free).

2.2 Completeness and independence of the five parts of an act

Reading the three starting facts of Recognition Science yields five parts of any recognition act (`ActPart`): `term` (what occurred), `comparison` (how much / what ratio), `record` (what was written and retained), `locus` (between which ports), and `order` (in what tick sequence). `ActualsParts.lean` settles both completeness and strict independence on the library's canonical protocol runs (`ActualsParts.five_parts_exact`) as well as on static bond ledgers, moral states, and action specifications (`bondLedger_complete`, `moralState_complete`, `action_complete`).

To verify that economic questions need neither fewer nor more parts, `EconActualsPartition.lean` defines the G5-clean economic case carrier `EconActCase N` with exactly five fields: `kind` (`term`), `amount` (`comparison`), `bookRec` (`record`), `locus` (`locus`), and `tick` (`order`), paired with two canonical binary questions `econAsk`: whether port 0 physically delivered a positive quantity to port 1, and whether the retained book agrees with that physical delivery.

Theorem 2 (Five-part completeness and independence on economic acts)**.** *For every finite horizon $N \in \mathbb{N}$ on* `EconActCase N`*:*

(i) ***Faithfulness and completeness*** *(*`econ_parts_faithful`*,* `econ_parts_complete`*, zero axioms): Two economic cases with identical five-part views are equal, so every question family on* `EconActCase N` *satisfies* `PartsComplete`*.*

(ii) ***Strict five-part independence*** *(*`econ_five_parts_independent`*,* `[propext]`*): Starting from* `econBase` *(produce* 1 *at port* 0 *at tick* 0*, deliver* 1 *from* $0 \to 1$ *at tick* 1*, record* $(0,1,1)$*), varying each part alone flips* `econAsk`*:* `econNoDeliver` *(term),* `econZeroAmt` *(comparison),* `econUnbooked` *(record),* `econOtherLocus` *(locus), and* `econEarlyDeliver` *(order: delivery attempted at tick* 0 *before production at tick* 1*). No four-part subset suffices.*

2.3 The Four-Way Economic Partition Theorem

We now instantiate `ActualsDomain` on the unified economic question type `EconQ`, partitioned syntactically into four disjoint slices before any candidate law $L : \mathrm{EconQ} \to \{0,1\}$ is supplied:

- **Law** (`EconLawQ`, 7 questions)**:** `stockConserved`, `unitFreeOpenFloorZero`, `netClaimsZeroSum`, `triangularNoArbIffZeroJ`, `creditCarryingVsDisagreement`, `wholeSingleChargedNotOnly`, `corpSeparationAndSuccession`. The basis `econBasis` anchors one physical probe

(`stockConserved = true`) and chains the remaining six by structural preserve-comparisons backed directly by proved physical theorems (`econ_law_backing`).

- **Choice** (`EconChoiceQ`, 4 questions)**:** `edgeworthPointPrice`, `agreedCreditRate`, `entityLegalForm`, `partialReleaseRule`—deliberately unprobed and untied in `econBasis`.
- **Gauge** (`EconGaugeQ`, 3 convention pairs)**:** `currencyUnitScale`, `displaySignFlip`, and `portLabelScheme`, each indexed by alt $\in \{0, 1\}$—unanchored individually, with exact relative ties (preserve on scale and port labels, reverse on display sign) and an explicit basis automorphism `econGaugeEquiv : BasisEquiv econBasis econBasis` that swaps every gauge pair while fixing Law, Choice, and History.
- **History** (`EconHistoryQ`, 3 run-local questions)**:** `port0ReadyPositive`, `crossing01Open`, and `tradeExecuted`—unprobed universally, yet realized with opposite bits across concrete valid ledger runs `moralStockInit` ($\text{ready}_0 = 0$, $\text{crossed}_{01} = 0$) and the post-production/transfer trace `moralStockWorld_produce_and_transfer` ($\text{ready}_0 = 1$, $\text{ready}_1 = 1$).

Theorem 3 (Exact Four-Way Economic Partition (`econ_actuals_four_way_partition`))**.** *With the candidate law* L : EconQ $\to \{0, 1\}$ *left unknown at the outset, across the universal basis* `econBasis` *and two-run realization family* `econWorldFamily`*:*

(i) ***Law:*** *On* `econLawBasis`*, there exists a unique compatible law* `econLawCode`*, every disagreeing code on any translated basis breaks an explicit traversed probe or comparison (*`econ_law_disagreement_has_witness`*, zero axioms), every Law address is* `Necessary` *across* `econWorldFamily`*, and any locally compatible proposed code agrees with* `econMountedCode` *on every Law address (*`econ_proposed_code_identified`*, zero axioms).*

(ii) ***Choice:*** *Every* $c \in$ EconChoiceQ *is unreached in* `econBasis`*, fails* `Necessary`*, and admits two compatible laws* L_1, L_2 *with* $L_1(\text{choice}\, c) = \text{true}$ *and* $L_2(\text{choice}\, c) = \text{false}$ *(*`choice_has_two_compatible_laws`*, zero axioms).*

(iii) ***Gauge:*** *Every* $g \in$ EconGaugeQ *is individually unreached and not* `Necessary`*, yet every compatible law fixes the relative ties (*`econGauge_relations_fixed`*, zero axioms), and pulling back along* `econGaugeEquiv` *preserves compatibility and every Law answer identically.*

(iv) ***History:*** *Every* $h \in$ EconHistoryQ *fails* `Necessary` *via Case 2 of* `not_necessary_cases`*, reaching* true *on one concrete* `PhysicalLedgerCore` *run and* false *on another.*

(v) ***Choice-free discrete settling*** *(*`econ_partition_settles_discrete`*): Finite streams of economic questions settle their four-way category membership computably at stage* N *using strictly* `[propext, Quot.sound]`*.*

Proof structure of Theorem 3. For (i), explicit finite derivations `econLawSliceDeriv` carry the anchor probe (`stockConserved = true`) along the six structural preserve-comparisons to reach every $q \in$ EconLawQ with bit `true`; Theorem 1(i), (ii), (iv), and (vi) immediately deliver uniqueness, path-localized zero-axiom disagreement witnesses, representative invariance, and proposed-code identification. For (ii), structural induction on `Reached` proves that only Law questions are reached in `econBasis` (`econBasis_reached_only_law`), so `free_of_unreached` constructs two compatible laws disagreeing on every Choice question. For (iii),

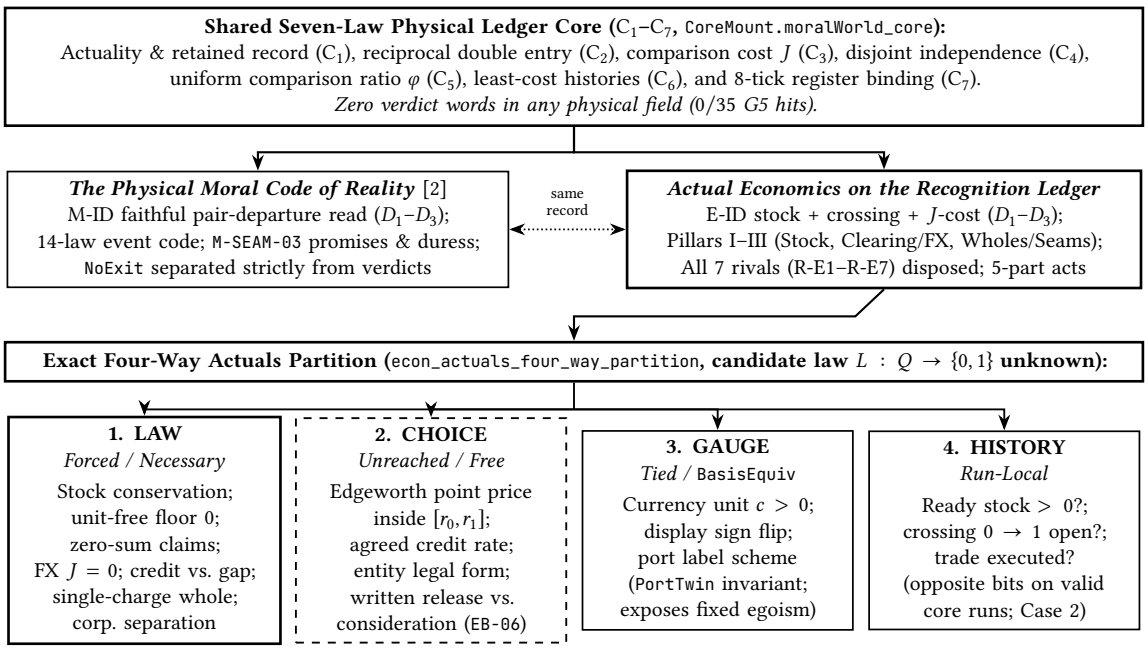


Figure 1. The unified architecture mounting both *The Physical Moral Code of Reality* and *Actual Economics* on one seven-law physical ledger core (`CoreMount.moralWorld_core`), together with the exact four-way *Actuals* partition separating forced economic Law from genuine Choice, pure Gauge, and run-local History.

each Gauge pair carries an exact comparison tie without any probe, fixing its relative parity via `relation_determined` while leaving individual orientations symmetric under the involution `econGaugeEquiv`. For (iv), the two valid `PhysicalLedgerCore` traces `moralStockInit` and `moralStockWorld_produce_and_transfer` realize opposite bits at every History address, exhibiting Case 2 of `not_necessary_cases`. □

Figure 1 displays the entire architecture at a glance. Every downstream pillar in Sections 3–5 supplies the concrete physical proofs backing the seven Law entries while certifying exactly where Choice, Gauge, and History remain open.

3 Pillar I: Located Physical Stocks, Unit-Free Open Floor, and Four-Live-Resource Minimality

Financial accounts cannot feed anyone on their own. Pillar I (`EconStockCore.lean`) mounts located physical production, storage, retrieval, consumption, and transfer directly beside any seven-law `LedgerWorld` W, proving how physical scarcity couples to double-entry records without conflating the two.

3.1 Coupled stock-and-ledger conservation, locality, and dual recording

Each port $p \in W$.Port holds a six-counter physical stock tuple

$$s = (\text{raw}, \text{ready}, \text{stored}, \text{consumed}, \text{effort}, \text{spent}) \in \mathbb{N}^6,$$

carrying conserved material material$(s) = 2 \cdot \text{raw} + \text{ready} + \text{stored} + \text{consumed}$ and conserved effort budget effortBudget$(s) = \text{effort} + \text{spent}$. One raw input holds two material units; internal production transforms (raw + 1, effort + 1) into (ready + 2, spent + 1); storage and retrieval move units between ready and stored; consumption moves one unit from ready to consumed (requiring ready > 0); and waiting leaves s unchanged. A coupled state is a pair `StockState W = (history, stock)`. Elementary transitions `StockStep` split cleanly into:

- `localOp p a e`: an internal event e strictly inside port p (`W.Inside e p`) executing local stock step a at port p and posting e to `history`;
- `transferOp p q e`: a crossing event e between apart distinct ports p, q (`Crosses W e p q`) moving one ready unit from port p to port q and posting e to `history`.

Theorem 4 (Physical stock conservation, locality, and dual recording)**.** *Let W be a* `LedgerWorld` *satisfying* `PhysicalLedgerCore W`*.*

(i) ***Conservation*** *(*`stock_trace_conserves`*,* `transfer_conserves_total_material`*): Every external transfer conserves* $\sum_{x \in S} \text{material}(\text{stock}(x))$ *over every finite region $S \ni p, q$, and every finite coupled trace* `StockTrace W st acts st'` *conserves both total network material and total network effort budget.*

(ii) ***Disjoint locality from*** C_4 *(*`local_op_preserves_apart_port`*): Under any internal operation* `localOp p a e`*, every apart port $q \neq p$ retains both identical physical stock* $\text{stock}'(q) = \text{stock}(q)$ *and identical restricted ledger record* $W.\text{restrict}(q, \text{history}') = W.\text{restrict}(q, \text{history})$*.*

(iii) ***Dual recording from*** $C_1 + C_4$ *(*`transfer_recorded_in_both_ports`*): Under any external transfer* `transferOp p q e`*, both* $W.\text{restrict}(p, \text{history}')$ *and* $W.\text{restrict}(q, \text{history}')$ *permanently hold e, and both restricted records compute the exact same crossing departure* $\text{crossed}(W, p, q)$*.*

(iv) ***Nonvacuous mount*** *(*`moralStockWorld_produce_and_transfer`*): On* `moralWorld` *with initial stock* $(1, 0, 0, 0, 1, 0)$ *at port* 0 *(Mara) and zero elsewhere, producing* 2 *loaves and transferring* 1 *to port* 1 *(Eli) yields a valid coupled trace conserving total material* 2 *with* $\text{ready}_0 = \text{ready}_1 = 1$*.*

3.2 The unique unit-free floor 0 and reserve undertakings

Economic rules often impose lower bounds on liquidity, capital, or reserves. What lower bound can belong to scale-free physical law rather than to a unit-dependent human contract? Define the open-or-closed domain

$$\text{OpenOrClosed}(a, b) \iff (0 < a \wedge 0 < b) \vee (a = 0 \wedge b = 0).$$

Theorem 5 (Zero is the unique unit-free floor)**.** *Across arbitrary positive scale changes $c > 0$ on $\mathbb{R}$:*

(i) ***Scale invariance and clean closure*** *(*`openOrClosed_scale_invariant`*,* `openOrClosed_permits_closing`*): For every positive rescaling $c > 0$,* $\text{OpenOrClosed}(ca, cb) \iff \text{OpenOrClosed}(a, b)$*, and $(0, 0)$ is admissible so settled obligations can close cleanly.*

(ii) ***Uniqueness of*** 0 *(*`zero_is_only_unit_free_floor`*): If* $f \geq 0$ *satisfies* $\forall c > 0$, $\forall x \in \mathbb{R}$, $(f \leq cx \iff f \leq x)$*, then* $f = 0$*.*

(iii) ***Positive floors are reserve undertakings*** *(*`nonzero_floor_is_reserve_undertaking`*): Every positive threshold* $f > 0$ *fails scale invariance at* $c = \frac{1}{2}, y = f$*; when a shortfall crossing of amount* $f - x > 0$ *posts between apart ports* p, q*, it opens crossing departure* $f - x > 0$ *and every faithful reading* M *satisfying* M-ID *reads it as strictly nonzero.*

Proof sketch. For (ii), if $f > 0$, applying invariance at $c = \frac{1}{2}$ and $x = f$ forces $f \leq \frac{1}{2}f$, a contradiction. Thus any positive capital adequacy ratio or liquidity buffer enters economics honestly as an authored reserve undertaking in a declared unit, never as a unit-free core law. □

3.3 Four-live-resource quotient minimality with permanent history

Does future operational feasibility depend on all six counters of a `Stock`, or only on a minimal quotient? Define the projection $\mathrm{live}(s) = (\mathrm{raw}, \mathrm{ready}, \mathrm{stored}, \mathrm{effort}) \in \mathrm{LiveResources}$ and test two stocks by every finite local action word after arbitrary initial supply $c \in \mathrm{LiveResources}$ (`operationTests`).

Theorem 6 (Four-live-resource quotient minimality (`live_resources_quotient_exact`))**.** *Let* operationTests *denote all contextual supply-and-action feasibility tests on* `Stock`*.*

(i) ***Operational equivalence*** *(*`observations_determine_live`*, choice-free): Two stocks are contextually indistinguishable (*`ObsEquiv operationTests s t`*) if and only if* $\mathrm{live}(s) = \mathrm{live}(t)$*, yielding the canonical bijection* `resourceQuotientEquiv`*:*

$$\mathrm{PhysicalQuotient}(\mathrm{operationTests}) \simeq \mathrm{LiveResources}.$$

(ii) ***Permanent historical retention (***C_1***):*** *The historical counters* (consumed, spent) *collapse completely inside the feasibility quotient (stocks* $(0,0,0,0,0,0)$ *and* $(0,0,0,1,0,1)$ *share one quotient class), yet every posted event recording consumption or spent effort remains permanently distinct and held in* $W.\mathrm{Rec}$ *by* C_1 *(*`NeverErased`*).*

Theorem 6 explains why balance sheets and income statements cannot be merged into one object: future physical feasibility factors through the four live stocks alone, whereas provenance, reliance, and past effort require the uncollapsed permanent record C_1.

3.4 Books cannot mint stock and choice-free discrete settling

Finally, `EconStockCore.lean` bridges `EffectRealization` (proving that any action moving a comparison reading from state s to t has uniquely forced active log-strains $\mathrm{profile}(t)_e - \mathrm{profile}(s)_e$, `effect_realization_bridge`) and separates financial books from physical goods:

Theorem 7 (Books cannot mint stock; choice-free discrete settling)**.** *On coupled physical-and-ledger carriers:*

(i) ***Stock vs. books*** *(*`books_cannot_mint_stock`, `no_books_reader_of_consumption_possibility_on_core`*): Every book-only move leaves every port's physical stock and total*

material invariant. On `moralWorld`*, no predicate of the ledger record* W.Rec *alone—and no predicate of the full crossing matrix* $(p, q) \mapsto \mathrm{crossed}(W, p, q, \mathrm{history})$ *even on traces reachable from* `moralStockInit`*—decides whether port* 0 *can execute* `consume`*.*

(ii) ***Choice-free discrete settling*** *(*`stock_feasibility_settles_discrete`*): For any fixed stock* s *and trace length* N*, the computable evaluator* `localFeasibleDecider s` *settles exact operational feasibility at finite stage* N *in* `DecisionRecords` *using strictly* `[propext, Quot.sound]`*.*

4 Pillar II: Zero-Sum Claims, Cut-Space Clearing, Round-Trip J-No-Arbitrage, Gauge Neutrality, and Credit Cost

Pillar II (`EconClearingCore.lean`) mounts the financial, clearing, foreign-exchange, credit, and distributional layers directly onto C_1–C_5, tying the recognition comparison cost $J(x) = \frac{1}{2}(x + 1/x) - 1$ to no-arbitrage, exact settlement, and credit carrying cost without assuming price-taking equilibrium or positive natural interest.

4.1 Zero-sum net claims and exchange conservation

Theorem 8 (Zero-sum claims on C_1–C_7 and exchange conservation)**.** *Across every finite port family and finite-network exchange:*

(i) ***Core zero-sum claims*** *(*`net_claims_sum_zero_on_core`*): On any* `PhysicalLedgerCore W` *and any* n *pairwise apart ports* $p_0, \ldots, p_{n-1}$*, for every record* r*,*

$$\sum_{i \neq j} \mathrm{crossed}(W, p_i, p_j, r) = 0;$$

if the ports cover all accounts, the full matrix sum $\sum_{i,j} \mathrm{crossed}(W, p_i, p_j, r) = 0$ *vanishes identically; and for every event* e *and covering account set* S*,* $\sum_{a \in S} \mathrm{amountAt}(W, e, a) = 0$*.*

(ii) ***Exchange creates neither goods nor aggregate value*** *(*`exchange_creates_no_goods_or_value`*): On any finite network of* n *ports and* m *goods with antisymmetric bilateral crossings* $C_{ij} = -C_{ji}$*, every* `NetworkExchange` *(shifting goods by* $\mathrm{flowGoods}_{ijg}$ *and crossings by antisymmetric* $dC_{ij} = -dC_{ji}$*) leaves every good's total stock* $\sum_i H_{ig}$ *and total network valuation* $\sum_i (\sum_g v_g H_{ig} + \sum_j C_{ij})$ *identically invariant for every valuation vector* $v \in \mathbb{R}^m$*, with total valuation equal purely to* $\sum_g v_g \sum_i H_{ig}$*. Every directed transfer cycle* $c_0 \to c_1 \to \ldots \to c_k \to c_0$ *has zero total net source, and every uniform circulation leaves zero net change at every individual port (*`arbitrage_cycle_zero_sum`*).*

4.2 Cut-space clearing and exact J-settlement

On a directed clearing graph with n ports, E bilateral claim edges (src, dst), and flow vector $t \in \mathbb{R}^E$, the net-balance operator $B : \mathbb{R}^E \to \mathbb{R}^n$ maps flows to port net positions, and its adjoint defines the cut space $\mathrm{Grad}(\mathrm{src}, \mathrm{dst}) \subseteq \mathbb{R}^E$. Because `CoreV1`'s comparison cost satisfies the exact hyperbolic identity $J(e^t) = \cosh t - 1$ (`cosh_sub_one_eq_Jcost_exp`), the nonlinear clearing cost $\mathrm{ratioCost}(t) = \sum_{e=1}^{E} (\cosh t_e - 1)$ equals the exact sum of C_3 recognition costs across edges (`ratioCost_eq_sum_coreV1_Jc_exp`).

Theorem 9 (Cut-space and exact settlement bridge (`ClearingBridge`)). *Across every finite clearing chart* (src, dst)*:*

(i) ***Cut-space sufficiency:*** *Two clearing graphs with identical cut space* $\mathrm{Grad}(\mathrm{src},\mathrm{dst}) = \mathrm{Grad}(\mathrm{src}',\mathrm{dst}')$ *produce identical minimum-norm settlements on every flow* t*.*

(ii) ***Bridge versus cycle dichotomy:*** *An unused edge* e_0 *alters settlement for some flow—and reversing* e_0 *alters settlement on some matched books with identical undirected amount profile—if and only if* e_0 *closes a cycle (*`CutSpaceDatum.ClosesCycle`*). Bridges never interact with cycles; cycle-closing edges change clearing topology even at zero initial flow.*

(iii) ***Unique exact*** J***-settlement:*** *Every feasible net-balance fiber* $\{t : B(t) = b\}$ *contains a unique minimizer* t^* *of* $\mathrm{ratioCost}(t) = \sum_e J(e^{t_e})$*, characterized exactly by the Euler–Lagrange condition*

$$B(t^*) = b \qquad \text{and} \qquad \left(\sinh t_e^*\right)_{e=1}^{E} \in \mathrm{Grad}(\mathrm{src},\mathrm{dst}),$$

with $\mathrm{ratioCost}(t) = 0 \iff t = 0$*.*

4.3 Triangular No-Arbitrage $\iff$ Round-Trip $J = 0$

Let $R : \mathrm{Fin}\, n \times \mathrm{Fin}\, n \to \mathbb{R}_{>0}$ be a positive reciprocal exchange-rate table ($R_{ii} = 1$, $R_{ij}R_{ji} = 1$). Define the triangular round-trip recognition cost

$$\mathrm{roundTripCost}(R,i,j,k) \;:=\; J\big(R_{ij}\,R_{jk}\,R_{ki}\big) = \tfrac{1}{2}\Big(R_{ij}R_{jk}R_{ki} + \frac{1}{R_{ij}R_{jk}R_{ki}}\Big) - 1.$$

Theorem 10 (No-Arbitrage $\iff$ Round-Trip $J = 0$). *For positive reciprocal exchange-rate tables* R *and core comparison worlds:*

(i) ***Exact characterization*** *(*`rate_table_is_price_vector_iff_zero_roundTrip_J`*): A positive reciprocal rate table* R *is generated by a single positive price vector* $p \in \mathbb{R}^n_{>0}$ *(*$R_{ij} = p_i/p_j$*) if and only if* $\mathrm{roundTripCost}(R,i,j,k) = 0$ *for all* i,j,k*.*

(ii) ***Core consistency*** *(*`core_compare_zero_roundTrip_J`*): On every* `PhysicalLedgerCore W`*, writing* $c_{xy} := W.\mathrm{compare}(x,y)$*, every triple* (a,b,c) *satisfies* $J(c_{ab}c_{bc}c_{ca}) = 0$ *by* C_2 *(*`ClosedChainsNetZero`*).*

(iii) ***Concrete spread witnesses*** *(*`spread_roundTrip_cost_quarter`*): The reciprocal* 3*-asset table* `triangleSpreadRates` *(*$R_{01} = 1$, $R_{12} = 1$, $R_{20} = 1/2$, $R_{02} = 2$*) has exact round-trip cost* $J(1/2) = \frac{1}{4} > 0$*, admits no price vector, and as an unexecuted quote leaves every physical stock and crossing state invariant. Similarly, a* 10% *FX dislocation (*$r = 11/10$*) carries* $J(11/10) = \frac{1}{220}$*, and a* 10% *discount spread (*$r = 9/10$*) carries* $J(9/10) = \frac{1}{180}$*.*

Proof. If $R_{ij} = p_i/p_j$, then $R_{ij}R_{jk}R_{ki} = 1$, so $J(1) = 0$. Conversely, if $J(R_{ij}R_{jk}R_{ki}) = 0$ for all triples, fix any anchor i_0 and set $p_i := R_{i,i_0} > 0$. Since $J(x) = 0 \iff x = 1$ on $x > 0$, $R_{ij}R_{j,i_0}R_{i_0,i} = 1$; multiplying by $R_{i,i_0} = R_{i_0,i}^{-1}$ yields $R_{ij} = R_{i,i_0}/R_{j,i_0} = p_i/p_j$. □

Figure 2 illustrates the exact reciprocal geometry: reversing the loop inverts $r \mapsto r^{-1}$ and preserves $J(r)$ identically, so arbitrage existence is a scale-free, direction-independent invariant of the rate table.

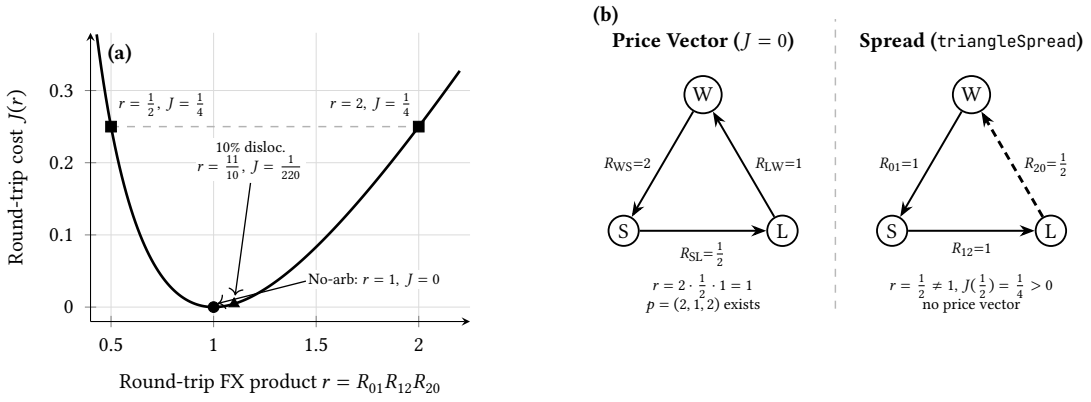


Figure 2. (a) The forced reciprocal comparison cost $J(r) = \frac{1}{2}(r + 1/r) - 1$ evaluated on triangular FX round-trip products $r = R_{01}R_{12}R_{20}$, symmetric under reversal $r \mapsto r^{-1}$ and vanishing uniquely at $r = 1$. (b) The Wheat–Silver–Linen exchange triangle: an arbitrage-free rate table factors through a single price vector p ($J = 0$), whereas the concrete spread witness `triangleSpreadRates` carries exact round-trip cost $J(1/2) = \frac{1}{4} > 0$.

4.4 Currency gauge neutrality and the carrying cost of credit

Rescaling every nominal quantity by any $c > 0$ (dollars to cents, grams to kilograms) must never change a physical law. Similarly, carrying an open credit balance that both parties *mutually acknowledge* is physically distinct from holding a disputed, unacknowledged imbalance.

Theorem 11 (Currency gauge neutrality and credit carrying cost)**.** *Across scale rescalings, matched credit lines, and mismatched books:*

(i) ***Currency unit is pure Gauge*** *(*`currency_unit_is_gauge`*): Every positive rescaling $c > 0$ leaves single-slot scale-free maps constant, fixes every price ratio $(cp_i)/(cp_j) = p_i/p_j$ and every round-trip J-cost, preserves* OpenOrClosed*, and preserves* M-ID *validity,* `BoundByRead` *direction, and ordering.*

(ii) ***Agreed credit carries zero native J-cost*** *(*`agreed_credit_zero_carrying_cost`*): On every clearing chart with matched positive books and every horizon $N \in \mathbb{N}$,* $\mathrm{standingCost}(C, \mathrm{bal}, N) = 0$ *and no positive per-tick interest floor is forced. Voluntary prices and interest rates inside any Edgeworth interval $[r_0, r_1]$ are mutually acceptable (*`Price.MutuallyAcceptable`*) and reachable as matched books, leaving both point prices and credit interest rates cleanly in* ***Choice****.*

(iii) ***Standing disagreement carries strictly positive per-tick cost*** *(*`disagreement_positive_carrying_cost`*): Whenever two positive books disagree on a relationship ($a \neq b$, $a, b > 0$), for every tick count $N \geq 1$ the standing strain is strictly positive:*

$$\mathrm{standingCost}(C_{one}, \mathrm{gap}(a, b), N) = N \cdot J(a/b) > 0,$$

and every chart containing a mismatched positive edge satisfies $\mathrm{standingCost}(C, \mathrm{bal}, N) > 0$.

4.5 Conserved-partition tail law: Zipf exponent 1, not φ, and discrete settling

A conserved binary recognition budget split recursively at the C_5 self-similarity ratio φ (where $\varphi^2 = \varphi + 1$) forces unique positive child weights $w_1 = 1/\varphi$ and $w_2 = 1/\varphi^2$ satisfying $w_1 + w_2 = 1$ and $w_1/w_2 = \varphi$. The stationary size-distribution tail index is the unique positive root of the Moran–Kesten equation $\mathrm{moranSum}(s) := w_1^s + w_2^s = 1$.

Theorem 12 (Zipf exponent 1, not φ; choice-free clearing settling). *On conserved golden partitions and discrete clearing streams:*

(i) ***Conserved partition forces Zipf*** *1 (*`conserved_partition_zipf_not_phi`*):* $w_1 + w_2 = 1$, $w_1/w_2 = \varphi$, $\mathrm{moranSum}(s) = 1 \iff s = 1$, *and* $\mathrm{moranSum}(\varphi) < 1$. *Thus conservation pins the stationary tail exponent uniquely at 1 (Zipf/Pareto-1), while φ governs solely the C_5 uniform comparison rung ratio (*`ladder_ratio_eq_goldenRatio`*).*

(ii) ***Choice-free discrete settling*** *(*`clearing_zero_sum_settles_discrete`*,* `triangular_noArb_settles_discrete`*): Both discrete zero-net circulation across n ports and exact integer-ratio triangular no-arbitrage ($n_{01}n_{12}n_{20} = d_{01}d_{12}d_{20}$) settle computably at finite stage N using strictly* `[propext, Quot.sound]`.

Theorem 12(i) carries direct empirical weight: it mathematically diagnoses why an earlier unforced guess predicting φ-geometric intermediary counts (1.618) on SWIFT gpi cross-border payments failed on first contact (`ECON-MISS-01`, Section 7.1).

5 Pillar III: Wholes, Corporate Personality, and the Three Multi-Party Commercial Seams

Pillar III (`EconWholeCore.lean`) addresses how groups, firms, and multi-party commercial contracts sit on the seven-law core. Every structure in this section carries zero verdict words (0/35 G5 hits) and resolves every multi-party seam left open by *The Physical Moral Code of Reality*.

5.1 Single charging of coalition burden and the member-ruin obstruction

For pairwise apart ports $p_0, \ldots, p_{n-1}$ on W and record r, define the off-diagonal pair cost $b_{ij}(r) := J(\exp(\mathrm{crossed}(W, p_i, p_j, r)))$ for $i \neq j$ (and 0 for $i = j$), each member's half-share burden $h_i(r) := \frac{1}{2}\sum_j b_{ij}(r)$, and full incident cost $c_i(r) := \sum_j b_{ij}(r) = 2h_i(r)$. For any coalition $G \subseteq \mathrm{Fin}\, n$, let $I(G) := \frac{1}{2}\sum_{i,j\in G} b_{ij}$ count every internal unordered bond once, $B(G) := \sum_{i\in G,\, j\notin G} b_{ij}$ count every boundary bond once, $\mathrm{wholeCost}(G) := I(G) + B(G)$, and $\mathrm{wholeBurden}(G) := \sum_{i\in G} h_i$.

Theorem 13 (Single charging and aggregate-ruin obstruction). *On any* `PhysicalLedgerCore W` *and pairwise apart port family:*

(i) ***Single charging and uniqueness*** *(*`whole_cost_single_charging`*,* `whole_cost_everyone`*,* `whole_burden_forced`*): For every coalition G,*

$$\sum_{i\in G} c_i = \text{wholeCost}(G) + I(G), \qquad \text{wholeCost}(G) = \text{wholeBurden}(G) + \tfrac{1}{2}B(G).$$

On the whole network $G = \operatorname{Fin} n$, $B(G) = 0$, so wholeCost = wholeBurden $= \sum_{i<j} b_{ij}$ *counts every bond strictly once, and any additive coalition functional matching member half-shares on singletons is uniquely forced to equal* wholeBurden *(bridged directly to* `MoralReading` *in* `whole_single_charging_bridge_moralReading`*).*

(ii) ***Aggregate gain hides member ruin*** *(*`aggregate_gain_hides_member_ruin`*): On* `moralWorld`*, there exist realized records $r_1 \preceq r_2$ such that total network cost strictly drops from $J(e^2)$ to $J(e^1)$, while port 2's half-share burden strictly rises from 0 to $\frac{1}{2}J(e^1)$ and port 2's reserve $1 + \text{written}((2,0))$ falls from 1 to 0.*

(iii) ***No aggregate-only admissibility rule*** *(*`no_whole_only_admissibility`*): Starting from the same opening record r_1 (cost $J(e^2)$), two realized continuations r_{safe} (every member's burden weakly drops and port 2 keeps reserve 1) and r_{ruin} (port 2's burden rises and reserve hits 0) share the* identical *aggregate cost pair $(J(e^2), J(e^1))$. No predicate $F(\text{wholeCost}_{\text{before}}, \text{wholeCost}_{\text{after}})$ can separate safe transitions from member-ruining ones.*

Theorem 13(iii) is the exact physical refutation of GDP-only and aggregate-welfare-only economics (R-E1): single-charged aggregate cost is well-defined and forced, yet mathematically blind to individual survival floors.

5.2 Member unions, dedicated corporate ports, reflective loss, and dissolution succession

Law and economics draw a sharp structural line between an informal partnership and an incorporated legal entity. On the seven-law ledger core, that distinction is not a legal fiction—it is the exact difference between two distinct port topologies:

- A `MemberUnion W` is a finite set U of pairwise apart individual ports whose accounts stay owned by the individual members themselves. Internal crossings among members sum identically to zero (`memberUnion_internal_cancels`), and a crossing between an outsider and member $m \in U$ lands strictly on m while leaving every $m' \neq m$ untouched (`memberUnion_keeps_member_standing`).
- A `CorporateEntity W` introduces a *dedicated port* C.corp apart from every shareholder $m \in C$.members, owning its own treasury and charter accounts (e.g. **The Bakery**, port 3, apart from Mara and Eli).

Theorem 14 (Reflective-loss separation and dissolution succession)**.** *Let W satisfy* `PhysicalLedgerCore W` *and let C be a* `CorporateEntity W`*.*

(i) ***Reflective loss separated*** *(*`reflective_loss_separated`*): For an outsider* out *apart from C.*corp *and every $m \in C$.*members*, a crossing of amount $u \neq 0$ between* out *and C.*corp *moves* crossed$(W, \text{out}, C.\text{corp})$ *by $+u$ while leaving every shareholder's restricted record*

and crossed(W, out, m) *completely unchanged (*$= 0$ *from empty). Conversely, a direct crossing between* out *and a shareholder* m *leaves* C.corp *untouched. This structurally recovers the no-reflective-loss rule (*Prudential / Foss v. Harbottle / Marex / Tooley *[15, 16, 17]).*

(ii) ***Dissolution succession preserves open claims*** *(*`corporate_dissolution_succession_preserves_claim`, `corporate_dissolution_exitWorld_witness`*):* *Suppose* C.corp *carries an open crossing* $u \neq 0$ *from counterparty* counter*, records an authored dissolution event* e_{diss} *activating* `canonicalSuccessionTransfer` *to successor* succ $\in C$.members*, and then freezes permanently (no future event touching* C.corp *has positive chance). Along* every *subsequent realized tick continuation* s*,* crossed$(W, \text{counter}, C.\text{corp}, s) = u \neq 0$*, the dissolution record stays held (*C_1*),* successorClaim$(\text{counter}, s) = u$*,* exitingResidual$(\text{counter}, s) = 0$*, and total claim is conserved without erasure or double-counting. On* `exitWorld`*, this resolves* `SA-02` *(*Levy v. Liebling */ MBCA §14.05 [18, 14]) constructively without invoking* `NoExit` *or* C_7*.*

5.3 The three multi-party commercial seams inherited from the moral-code blind check

In the companion pre-registered blind verdict test of *The Physical Moral Code of Reality* [2, §6], all three REAL_MISS outcomes occurred exclusively on multi-party commercial attachment seams: debt assignment with notice (`W1-009`), private third-party duress against an innocent relying lender (`W1-037`), and voluntary partial debt concession without fresh consideration (`W1-060`, *Levine v. Blumenthal*). Mounting economics on the exact same seven-law core resolves all three seams cleanly and without verdict smuggling:

Theorem 15 (Resolution of the three multi-party commercial seams)**.** *Mounted directly on* C_1–C_7 *with zero verdict words in any carrier structure:*

(i) ***Seam 1—Assignment before and after notice*** *(*`W1-009`*; UCC §9-406(a), Rest. (2d) §338 [12, 13]):* *Given an* `AssignmentNotice` *across apart ports* (orig, assignee, remitter) *with assignment event* e_{assign} *(untouched by* remitter*) and later notice event* e_{notice} *(touching* remitter *at first tick* t_{notice}*):*

- Before notice (`assignment_before_notice_payment_protects_debtor`): *At any prefix tick* $t_{\text{pay}} < t_{\text{notice}}$*, neither* e_{assign} (C_4) *nor* e_{notice} (C_1) *sits in* remitter*'s restricted record, and paying* u *to* orig *closes* crossed(remitter, orig) *cleanly to* 0*.*
- After notice (`post_notice_misdirected_payment_opens_retention`): *Once both* e_{assign} *and* e_{notice} *are held, a misdirected payment of* $v > 0$ *from* remitter *to* orig *leaves* assignee*'s restricted record and* crossed(remitter, assignee) *unchanged (*C_4*), opens exact retention* $v > 0$ *at* orig *conserving* crossed(remitter, orig)$' + v = u$*, and remitting* v *from* orig *to* assignee *closes retention with zero double-recovery.*

(ii) ***Seam 2—Private third-party duress versus innocent relying bank*** *(*`W1-037`*; Rest. (2d) §175(2),* Etridge *[13, 20]):* *Define* `LocalVisibilityClear W bank r e_threat` *as* $\neg W$.Holds$(W.\text{restrict}(\text{bank}, r), e_{\text{threat}})$*. Whenever* e_{threat} *touches only* {coercer, guarantor}*,* C_4 *guarantees* `LocalVisibilityClear` *for* bank *on every record* r *even when* e_{threat} *is globally held (*`private_threat_invisible_to_innocent_bank`*).*

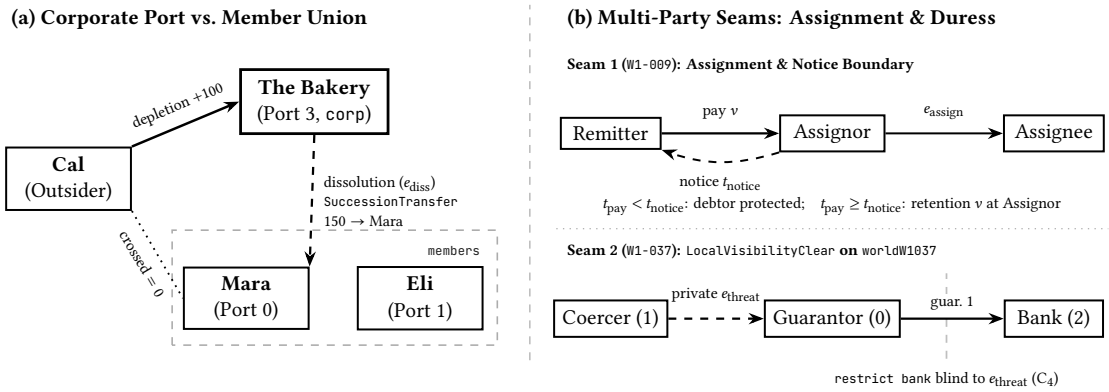


Figure 3. (a) Dedicated corporate port (**The Bakery**) separated from shareholders (**Mara**, **Eli**): an outsider's depletion lands strictly on port 3 (no reflective double-recovery), while dissolution freezes the open receivable and passes it intact via `SuccessionTransfer`. (b) Multi-party commercial seams closed on $C_1 + C_4$: assignment notice timing (`W1-009`) and local visibility isolation of private third-party duress (`W1-037`).

On the concrete 4*-port seven-law core world* `worldW1037` *(*0 = guarantor, 1 = coercer, 2 = bank, 3 = env*),* `third_party_duress_split_vs_universal_void` *proves that* `goodFaithReliancePolicy` *and* `universalVoidPolicy` *disagree on* $v > 0$ if and only if `LocalVisibilityClear` *holds: on the realized duress witness* r_{tri} *where the guarantor's undertaking is* `DuressInduced` *and the bank advances* 1 *innocently, universal voiding inflicts uncompensated loss* 1 *on the innocent bank, whereas good-faith reliance preserves* (1 → bank) *with* 0 *bank loss and opens exact indemnity* (1 → guarantor) *against the coercer.*

(iii) ***Seam 3—Voluntary written partial release versus consideration*** *(*`W1-060`*;* Levine v. Blumenthal / Foakes v. Beer *vs. Cal. Civ. Code §1524 / NY GOL §5-1103 / UCC §1-306 [21, 22, 12]): For a creditor-controlled* `PartialReleaseRecord`*,* `writtenReleaseRule` *(closing* $\Delta > 0$ *without fresh counter-crossing) and* `classicalConsiderationRule` *(requiring* freshCounterAmt > 0*) agree on every* `BargainedModification` *and disagree on every* `VoluntaryPartialRelease` *(*Δ *vs.* 0*). Theorem* `modification_rule_is_attachment_choice` *constructs a literal* `AdmissibleRival` *on* `moralWorld`*, proving that choosing between statutory written release and classical consideration is an explicit institutional* ***Choice*** *boundary rather than a contradiction of the physical core.*

(iv) ***Choice-free discrete settling*** *(*`whole_and_seam_verdict_settles_discrete`*): All five discrete whole-and-seam queries (direct corporate standing, dissolution succession, post-notice retention, intermediary visibility, and parameterized partial release) settle computably at finite stage* N *using strictly* `[propext, Quot.sound]`*.*

Figure 3 renders both structural separations visually: every single barrier follows directly from port disjointness (C_4) and append-only record order (C_1), with zero ad-hoc legal predicates embedded in the ledger.

6 Disposal of Seven Economic Rivals, Rule R Closure, and the Unified Joint Stack

Under Rule R, no competing economic doctrine may be dismissed in prose alone. `EconRivals.lean` disposes of all seven major economic rivals (R-E1–R-E7) directly in Lean 4 using explicit counterexamples and literal `CoreV1` `GhostCertificates`, while `EconClosureStatus.lean` enforces a pure zero-axiom four-axis status discipline.

6.1 Three-way classification and disposal of R-E1–R-E7

Theorem 16 (Disposal of all seven rivals and three-way split (`all_seven_econ_rivals_disposed`, `econ_three_way_rival_split`))**.** *Every economic competitor mounted against the seven-law ledger core falls into exactly one of three formal classes:*

(I) ***Refuted rivals (***R-E1–R-E7***) and broken-world ghosts (***C_1, C_2, C_4***):*** *All seven major rivals are formally refuted in Lean (*`rival_RE1_aggregate_gdp_only_refuted` *through* `rival_RE7_free_lunch_triangular_arbitrage_refuted`*), accompanied by six literal* `CoreV1` `GhostCertificate`*s proving* $\neg$PhysicalLedgerCore(W) *for forgetting records (*C_1*), unread exit accounts (*C_1*), zero-amount postings (*C_2*), four-entry compound set-offs (*C_2*), nonzero closed comparison tolls (*C_2*), and unclean port restriction (*C_4*).*

(II) ***Harmless Gauge conventions*** *(*`econ_gauge_twins`*):* *Currency unit scaling ($c > 0$), display sign flip, and port relabelling (*`PortTwin` *and* `econGaugeEquiv`*) preserve every physical economic invariant—while* `fixedEgo_twin_variant` *exposes hidden port-label favoritism and* `conventionTwin_forgets_ports` *proves that bare register twins drop port ownership.*

(III) ***Genuine Choice and open attachment seams:*** *Literal* `AdmissibleRival` *witnesses on* `moralWorld` *and* `exitWorld` *certify voluntary partial release versus consideration (*`modification_rule_is_attachment_choice`*), port exit (*`exitWorld_rival_to_portCanPost`*), all four* `EconChoiceQ` *extensions, and third-party duress visibility.*

Table 2 maps every rival, gauge twin, and Choice seam to its exact Lean 4 theorem.

6.2 Rule R four-axis closure, G3 (E-ID), G5 scan, and traps `EG1–EG6`

To prevent mathematical derivation, computability, empirical testing, and Lean formalization from ever being conflated, `EconClosureStatus.lean` implements the exact Rule R twin of `CoreMount/MoralClosureStatus.lean`:

1. **Zero-axiom computed status kernel (`econView`):** Every row carries four independent axes—Law (`P0–P2`), Evaluation (`C0–C3`, `C_notSettleable`, `C_na`), Empirical (`E0–E2`, `ET`, `MISS`), and Formalization (`F0–F2`)—plus explicit Rule R guard flags. A total decidable kernel function `econView` computes the headline status with **zero axioms**, obeying four zero-axiom dominance theorems: `miss_dominates` (any un-preregistered miss forces `REAL_MISS`), `falsePremise_dominates`, `emp_miss_blocks_empirical_pass` (an empirical miss can never display `DERIVED` or `ACCEPTED_STAR`), and `derived_needs_core` (`DERIVED` requires `P2`, `F2`,

Rival / Convention	Class	Exact physical failure or invariance	Lean 4 disposal witness
R-E1: Aggregate / GDP-only scalarism	Refuted rival	Identical $(J(e^2), J(e^1))$ drop hides port-2 ruin; T_3 blindness	`rival_RE1_aggregate_gdp_only_refuted`
R-E2: Books-only / money without stock	Refuted rival	Book postings conserve stock identically; cannot decide `consume`	`rival_RE2_books_only_without_stocks_refuted`
R-E3: Unilateral circular set-off	Refuted + C_2 ghost	Zero net hides opposite cycles (T_3); R_{5a} debtor control; 4-entry ghost	`rival_RE3_unilateral_circular_setoff_refuted`
R-E4: Forced natural interest / free gap	Refuted rival	Matched credit has 0 J-cost; mismatch incurs $N \cdot J(a/b) > 0$	`rival_RE4_natural_interest_or_free_disagreement_refuted`
R-E5: Forced single-point price / planner	Refuted rival	Nondegenerate $[r_0, r_1]$ admits distinct prices; `EconChoiceQ` unreached	`rival_RE5_forced_single_point_price_refuted`
R-E6: Whole collapses member / exit erases	Refuted + C_1 ghost	Dedicated `corp` separates reflective loss; `exitWorld` keeps 1; unread ghost	`rival_RE6_whole_collapses_member_and_dissolution_erases_refuted`
R-E7: Free-lunch FX arbitrage / zero spread	Refuted + C_2 ghost	Spread gives $J(1/2) = \frac{1}{4} > 0$, no p; net-toll C_2 ghost	`rival_RE7_free_lunch_triangular_arbitrage_refuted`
G1–G3: Currency scale, sign flip, port labels	Gauge twin	Invariant under $c > 0$, sign swap, `PortTwin`, `econGaugeEquiv`	`econ_gauge_twins`, `econ_convention_twins`
Choice / Attachment / Exit seams	Admissible rival	Open across C_1–C_7 (`AdmissibleRival`, `EB-06`, `exitWorld`)	`econ_three_way_rival_split`

Table 2. Complete formal disposal of all seven major economic rivals (R-E1–R-E7), three harmless gauge conventions, and genuine Choice / open attachment seams directly in Lean 4 (`EconRivals.lean`).

zero misses, zero admissible rivals, zero G5 flags, zero prose-only rival dismissals, and G3 passage).

2. **G3 three-domino restatement test for** E-ID**:** The single physical economic identification

> **Identification** E-ID**:** *Economic position is located physical stock coupled to* core_v1 *crossing departures and J-cost.*

earns `DERIVED` standing only by passing G3 (`econIdRestatementRecord_passes_G3`, zero axioms; real Lean witness `econ_id_dominoes_in_lean`, `std3`) via three independent non-trivial dominoes, each proved false under its named rival:

- **Domino D_1 (Stock-vs-books rigidity):** Book postings never mint stock and cannot decide consumption feasibility (`books_cannot_mint_stock`; refuted under R-E2).
- **Domino D_2 (Circulation and cut-space clearing):** Three-party circulation (T_3), debtor-controlled crossing movement (R_{5a}), and cycle-closure clearing (`ClearingBridge`; refuted under R-E1/R-E3).
- **Domino D_3 (Round-trip J, disagreement cost, and zero floor):** FX no-arbitrage $\iff$ $J = 0$ ($J(1/2) = \frac{1}{4}$), disagreement carrying strain $N \cdot J(a/b) > 0$, and unique unit-free floor 0 (refuted under R-E4/R-E7).

3. **G5 zero-hit encoding scan (`econG5Scan_clean`, zero axioms):** Scanning every field name of every mounted physical-carrier structure across `EconStockCore`, `EconClearingCore`, `EconWholeCore`, and `EconActualsPartition` against the 35 banned verdict words (`theft`, `guilty`, `wrong`, `victim`, `duty`, `owed`, `liable`, `promise`, `consent`, `duress`, etc.) returns the empty list `econG5Hits = []` by kernel `rfl`.

4. **Six anti-rubber-stamping trap fixtures (`EG1`–`EG6`, zero axioms):** Six adversarial fixtures verify that `econView` mechanically rejects: `EG1` smuggled single-lemma restatements or G5-flagged adapters; `EG2` prose-only rival dismissals; `EG3` name-punning C_7 `CycleSettlesEveryObligation` into commercial debt clearing (accompanied by `eg3_`

Economic closure row	P	C	E	F	Computed econView
Stock conservation & books separation	P2	C1 (ch.-free)	E2	F2	**DERIVED**
Unit-free open floor 0; 4-live-resource quot.	P2	C1 (ch.-free)	E1	F2	**DERIVED**
Zero-sum claims; FX J=0; cut-space; credit/gap	P2	C1 (ch.-free)	E2	F2	**DERIVED**
Whole single-charging/ruin; corp. & dissolution	P2	C1 (ch.-free)	E2	F2	**DERIVED**
E-ID identification (pre-G3 → post-G3)	P2	C1	E2	F2	ACCEPTED_STAR → **DERIVED**
Conserved-partition Zipf exponent 1 (not φ)	P2	C2	E1	F2	**DERIVED**
Exact unbanded real zero vs. banded real	P2	C_notSet/C2	E0	F2	LAW_DERIVED_COMP_OPEN / **DERIVED**
Currency unit, sign display, port labels	P2	C_na	E0	F2	**UNIT_CONVENTION**
Edgeworth point price; release rule (EB-06)	P1	C0/C1	E0/E2	F2	**OPEN_PHYSICS** (Choice)
Informal human signal operational attachment	P1	C0	E0	F1	**OPEN_PHYSICS** (Adapter)
SWIFT gpi φ-guess (ECON-MISS-01)	P1	C2	MISS	F1	**REAL_MISS** (retired)
Shared bio $J(\varphi^k)$ (MORAL-MISS-01)	P1	C2	MISS	F1	**REAL_MISS** (inherited)

Table 3. Four-axis Rule R status register computed mechanically by the zero-axiom kernel function econView (econ_closure_status_view). Both empirical misses dominate unconditionally into REAL_MISS; genuine Choice and open adapters separate cleanly from forced Law and Gauge.

c7_exitWorld_counterexample); EG4 hiding empirical or blind misses (ECON-MISS-01, MORAL-MISS-01, EB-02-Q3, EB-11-Q1); EG5 mis-tagging an AdmissibleRival Choice seam as mathOpen; and EG6 confusing a C_2 broken-world ghost, a gauge twin, and a genuine Choice seam.

6.3 Joint Stack Capstone and Four-Axis Status Register

Theorem 17 (Unified Actuals, Morality, and Economics Stack (unified_actuals_morality_economics_mounted))**.** *One single seven-law physical core witness* CoreMount.moralWorld_core *simultaneously certifies:*

(i) The Physical Moral Code of Reality *(*structuralMoralLedgerClaim*,* M-SEAM-03 *timed crossing and consent/duress attachment, G3 passage, and honest preservation of* MORAL-MISS-01*);*

(ii) Actual Economics *(*structuralEconLedgerClaim*,* econ_core_v1_forced*, G3 passage,* 0*-hit G5 scan,* UNIT_CONVENTION *gauge rows,* OPEN_PHYSICS *choice seams, and honest preservation of* ECON-MISS-01 *and both blind encoding misses);*

(iii) *Shared* ActualsDomain *Law necessity with Choice/Gauge/History separation and shared* ActualsParts *five-part completeness and independence across both protocol and economic acts;*

(iv) *Shared Ghost /* ConventionTwin */* PortTwin */* AdmissibleRival *discipline across both domains.*

Table 3 presents the computed four-axis Rule R register (econ_closure_status_view, zero axioms).

7 Pre-Registered Blind Economic and Commercial Verdict Check (Misses First) and Empirical Record

Formal proofs check internal consistency; pre-registered blind tests check external contact. Under Rule R and `SCORING_RUBRIC.md` §3.4, every miss is reported first, unsoftened, before any pass count.

7.1 Misses first: append-only empirical and blind-check record

Four entries sit permanently in the append-only register `econMisses` of `EconClosureStatus.lean` (`econ_blind_tally_verified`, zero axioms):

1. **Blind raw miss 1—`EB-02-Q3` (Suite B, post-notice claim assignment + payment to original creditor; UCC §9-406(a), Rest. (2d) §338(1)):** Filed prediction `"0"` versus sealed ground truth `"200"`. *Pre-registered classification:* `Q_ENCODING_ERROR` (raw unadjusted miss; *not* a `CORE_LAW_DEFECT` or `ATTACHMENT_BOUNDARY` miss). *Verifiable cause:* The frozen engine (`FROZEN_ECON_RULE_v1_1.py`) applied Seam 1 post-notice assignment law accurately at lines 470–475—passing `EB-02-Q1` (debtor not discharged), `EB-02-Q2` (P1 still owes 200 to assignee P3), and `EB-02-Q4` (double-recovery cap 200), while recording `self.disgorgements[("P2","P3")] = 200`. At line 671, however, `query_net_obligation` looked up the literal string key `("P2","any_rightful_claimant")` in `self.disgorgements` instead of summing over the wildcard destination (which it already implemented five lines below at lines 677–684 for `direct_claim`). The frozen engine was **not** edited retroactively; `EB-02-Q3` remains a raw miss in the unadjusted tally (86/88).

2. **Blind raw miss 2—`EB-11-Q1` (Suite B, conflicting sales of one unique physical unit + delivery to second buyer; Physical Stock Conservation, UCC §2-403(1), §2-711, §2-713):** Filed prediction `True` (`both_deliveries_feasible`) versus sealed ground truth `False`. *Pre-registered classification:* `Q_ENCODING_ERROR` (raw unadjusted miss; *not* a `CORE_LAW_DEFECT`). *Verifiable cause:* At line 917, `eval_scarcity_delivery` queried static `case.get("book_entries", [])` instead of `ts.obligations`. Because both conflicting obligations (`OBL-1`, `OBL-2`) in `EB-11` were formed via chronological `agreement_formed` events rather than static `book_entries`, the loop saw zero obligations and evaluated $0 \geq 0 \rightarrow$ True. On the exact same case, `TimelineState` tracked both obligations cleanly and passed `EB-11-Q2` (title held by P3), `EB-11-Q3` (seller breached P1), and `EB-11-Q4` (damages 120 = prepaid 100 + cover differential 20). Again, the frozen engine was **not** edited retroactively; `EB-11-Q1` remains a raw miss in 86/88.

3. **Historical empirical refusal—`ECON-MISS-01`** (SWIFT gpi hop-count test, 12 Nov 2026)**:** An unforced pre-registered φ-geometric guess predicting 1.618 intermediaries per cross-border payment was refused on first contact against FSB (2023) and CPMI (2022) SWIFT gpi measurements (observed mean 0.829; 76% direct zero-intermediary settlement [23, 24]). Theorem 12(i) (`conserved_partition_zipf_not_phi`) provides the exact mathematical diagnosis: conserved binary splitting fixes the tail exponent at 1, never at φ-geometric hop rates. `ECON-MISS-01` remains permanently logged as REAL_MISS.

4. **Inherited core empirical refusal—`MORAL-MISS-01` (12 Nov 2026):** The 55,422-record

Step	Time (CT)	Locked artifact	Mode	SHA-256 prefix (16 hex)
1	02:50:42 CST	CASE_INPUT_SCHEMA.md & STRIPPER_SEAL.txt	444	0053107674aeee05 / f60c0bf685714468
2	02:50:42 CST	suite_{a,b,c}/sealed_outcomes/outcomes.json	444	70ec6627 / a85ce61d / 53908fc5
3	02:54:50 CST	SCORING_RUBRIC.md (locked prior to opening)	444	906abab0af31b632
4	02:55:18 CST	FROZEN_ECON_RULE_v1_1.py & lock receipt	444	bc163ae128942455 / 68c077979e341221
5	02:55:21 CST	FILED_PREDICTIONS_SUITE_{A,B,C}.json (91 Qs)	444	767e81df / 6c1fa1f0 / d7e16639
6	02:55:53 CST	Unseal & deterministic score (8/8 hashes @ 02:57:13)	—	FINAL_SCORE_DATA.json

Table 4. Chronological pre-registration and SHA-256 audit trail (26 November 2026, US Central Time). All 8/8 SHA-256 locks verified intact bit-for-bit after scoring with zero retroactive edits to the frozen engine or filed predictions.

biological harm-magnitude test of discrete $J(\varphi^k)$ quantization failed across all four channels [2] and stays permanently recorded on the shared CoreV1 miss register.

7.2 Cryptographic pre-registration and chronological lock trail

To eliminate hindsight bias, an isolated case-authoring and stripping team (Team 3A) converted 26 economic and commercial disputes (91 binary and exact-rational questions) across three suites into anonymized facts_only/ JSON records stripped of all case citations, legal names, and outcome hints (STRIPPER_SEAL.txt: 0 schema errors, 0 leak hits) and sealed all ground-truth outcome files with chmod 444 at 02:50:42 CST on 26 November 2026. Without reading any outcome file, SCORING_RUBRIC.md and the deterministic engine FROZEN_ECON_RULE_v1_1.py (implementing solely the mounted Lean core laws, passing --self-test and PortTwin port-permutation invariance, with hard-coded --max-fails 3 early-stop cutoffs) were locked read-only at 02:55:18 CST. All 91 predictions across Suites A, B, and C were executed blindly and locked read-only at 02:55:21 CST (FILING_RECEIPT.txt), 32 seconds before unsealing at 02:55:53 CST. Every SHA-256 lock verified bit-for-bit (8/8 PASS) at 02:57:13 CST (Table 4).

7.3 Complete 26-case scorecard and epistemic tier audit (E1 vs. E2)

Across all 26 blind cases (88 uncontested questions plus 3 explicitly contested questions on EB-06), the frozen engine scored:

- **Suite A (Accounting, Clearing & FX, 7 cases): 30/30 (**100.0%**)** uncontested PASS (7/7 cases), 0 core defects, 0 encoding misses.
- **Suite B (Commercial, Contract, Agency & Corporate, 12 cases): 31/33 (**93.9%**)** uncontested PASS, **3/3 (**100.0%**)** Q_CONTESTED_MATCH on EB-06 (matching the modern statutory written-release rule, explicitly separated from uncontested accuracy), 0 core defects, 0 attachment-boundary real misses, and 2 mechanical Q_ENCODING_ERROR raw misses (EB-02-Q3, EB-11-Q1).
- **Suite C (Scarcity, Production, Commons & Whole-vs-Member, 7 cases): 25/25 (**100.0%**)** uncontested PASS (7/7 cases), 0 core defects, 0 encoding misses.
- **Combined total: 86/88 (**97.7%**)** uncontested PASS, **3/3** contested match, **0** CORE_LAW_DEFECTs, **0** ATTACHMENT_BOUNDARY REAL_MISSes, **2** unpatched Q_ENCODING_ERROR raw misses,

Case	Tier	Stripped domain & unsealed reference	Score	Result
EA-01	E1-Canon.	3-party circular claims + unilateral set-off (*Orexigen* / 11 U.S.C. §553)	4/4	CASE_PASS
EA-02	E1-Canon.	Triangular FX no-arb, dislocation ($J=\frac{1}{220}$), spread ($J=\frac{1}{180}$)	7/7	CASE_PASS
EA-03	E2-Strip.	Parent–subsidiary consolidation + unack. intragroup (ASC 810 / IFRS 10)	4/4	CASE_PASS
EA-04	E1-Canon.	4 domestic sectors + RoW bilateral balances (UN SNA 2008 / IMF BPM6)	3/3	CASE_PASS
EA-05	E1-Canon.	Tiered insolvency waterfall, pari passu ($60, \frac{80}{3}, \frac{40}{3}, 0$; §726)	4/4	CASE_PASS
EA-06	E1-Canon.	Bridge vs. cycle-closing edge ($\beta_1 = \lvert E\rvert - \lvert V\rvert + c$; CutSpaceDatum)	4/4	CASE_PASS
EA-07	E1-Canon.	Agreed 0-int. credit (0 carrying) vs. overdue gap (Rest. §354 / UCC §3-112)	4/4	CASE_PASS
EB-01	E1-Canon.	Direct corporate depletion, 2 shareholders (*Prudential*/*Marex*/*Tooley*)	3/3	CASE_PASS
EB-02	E2-Strip.	Post-notice assignment + payment to assignor (UCC §9-406; Rest. §338)	**3/4**	MISS_ENC (Q3)
EB-03	E1-Canon.	Third-party threat unknown to innocent bank (Rest. §175(2) / *Etridge*)	3/3	CASE_PASS
EB-04	E1-Canon.	Debt-free corporate dissolution (*Levy v. Liebling* / MBCA §14.05)	2/2	CASE_PASS
EB-05	E1-Canon.	Unauthorized non-merchant bailment transfer (*nemo dat* / UCC §2-403)	3/3	CASE_PASS
EB-06	E1-Canon.	Voluntary written partial release (*Foakes*/*Levine* vs. Cal. §1524/NY GOL)	**3/3***	CONTESTED_MATCH
EB-07	E2-Strip.	Matched books contradicted by 0-delivery physical audit (ASC 606 / IFRS 15)	3/3	CASE_PASS
EB-08	E1-Canon.	Pre-notice assignment + payment to assignor (UCC §9-406; Rest. §338)	3/3	CASE_PASS
EB-09	E2-Strip.	Unsolicited 3rd-party payment reversed pre-ratification (*Walter v. James*)	3/3	CASE_PASS
EB-10	E2-Strip.	Release signed under protest after bad-faith hold-up (*Rich & Whillock*)	3/3	CASE_PASS
EB-11	E2-Strip.	Conflicting unique-unit double-sale + cover (UCC §2-403, §2-711, §2-713)	**3/4**	MISS_ENC (Q1)
EB-12	E2-Strip.	Undisclosed selling-agent side payment (Rest. Agency §8.02 / *FHR*)	2/2	CASE_PASS
EC-01	E1-Canon.	Higher aggregate total with member-floor breach (no_whole_only_admissibility)	4/4	CASE_PASS
EC-02	E1-Canon.	Strict-complement Leontief production bottleneck (LiveResources)	3/3	CASE_PASS
EC-03	E1-Canon.	Positive matched book receivable with 0 ready/stored stock (books_cannot_mint)	3/3	CASE_PASS
EC-04	E2-Strip.	Shared replenishable pool + background load + 4 extractors	4/4	CASE_PASS
EC-05	E1-Canon.	Two dated delivery undertakings on one indivisible unit (*qui prior*)	3/3	CASE_PASS
EC-06	E1-Canon.	Bilateral trade proposals inside/outside Edgeworth band (Choice)	4/4	CASE_PASS
EC-07	E1-Canon.	Split complementary inputs across two parties requiring cooperation	4/4	CASE_PASS
Total	**18 E1 / 8 E2**	**26 cases, 91 Qs: 0 core defects, 0 attachment misses, 2 lookup bugs**	**86/88**	**97.7% + 3/3***

Table 5. Complete 26-case (91-question) pre-registered blind scorecard (FROZEN_ECON_RULE_v1_1.py, locked read-only before unsealing). Both unpatched mechanical lookup misses (EB-02-Q3, EB-11-Q1) are marked in bold; the asterisk on EB-06 denotes 3/3 Q_CONTESTED_MATCH reported separately from uncontested accuracy.

and **0** early-stop triggers.

Crucially, every seam inherited from the companion moral-code blind test passed blind under Actual Economics: reflective loss (EB-01: 3/3), third-party duress against an innocent relying lender (EB-03: 3/3), corporate dissolution succession (EB-04: 2/2, formerly SA-02), unauthorized non-merchant bailment (EB-05: 3/3), pre-notice assignment (EB-08: 3/3, formerly W1-009), and the Choice boundary between classical consideration and statutory written release (EB-06: 3/3 Q_CONTESTED_MATCH).

Per SCORING_RUBRIC.md §1, we never inflate canonical textbook identities into novel empirical discoveries: 18 cases are explicitly tagged E1-Canonical-Stripped (blind-executed on anonymized JSON, yet testing standard accounting, FX, microeconomic, or headline legal doctrines), while 8 cases (EA-03, EB-02, EB-07, EB-09, EB-10, EB-11, EB-12, EC-04) are tagged E2-Stripped (novel multi-fact compound disputes). Honestly noting the subset split: both raw lookup misses occurred inside E2-Stripped, giving **23/25 (**92.0%**)** raw uncontested accuracy and **0** substantive core-law defects on E2. Table 5 lists all 26 cases.

Module	Lines	Decls	Pub. thms	src_sha (12)	Principal verified content
ActualsDomain.lean	915	83	59	b95b004dcb31	Thm. 1, Thm. 3 (0-ax), Cor. 5–6 (0-ax)
ActualsParts.lean	536	57	35	3175551c6071	5-part act completeness & independence
EconStockCore.lean	960	65	34	7c3196734ff9	Stock cons., floor 0, 4-live quot., ch.-free
EconClearingCore.lean	781	45	25	66bb808256f8	Zero-sum, cut-space, FX J=0, credit, Zipf 1
EconWholeCore.lean	1,808	79	27	64aaaed8af54	Single charge, ruin, corp., Seams 1–3
EconActualsPartition.lean	1,054	76	34	093f2d887eaf	4-way Law/Choice/Gauge/History + 5 parts
EconRivals.lean	466	10	10	0723475931fa	All 7 rivals (R-E1–R-E7), 3 gauge twins
EconClosureStatus.lean	1,090	79	21	247e61075f2c	0-ax econView, G3, G5, G8, EG1–EG6
UnifiedActualsStack.lean	127	1	1	cbe3182cb029	Joint Moral + Econ mount on moralWorld
9 Library Modules	**7,737**	**495**	**246**	**0 sorry / 0 warn**	**Phase-Gate Verdict: YES**
EconCore_axioms.lean	143	0	0	38e6df76c238	111 audited: 26 zero-ax, 14 ch.-free, 71 std3

Table 6. Machine-checked Lean 4 verification inventory (VERIFY_econ_core_mount.txt, ladder-build-c, Lean v4.27.0-rc1, -DautoImplicit=false -DwarningAsError=true, 0 sorry, 0 warnings, 0/35 G5 hits).

8 Machine-Checked Lean 4 Inventory, Exact Open Frontier, and Conclusion

8.1 Machine-checked Lean 4 verification inventory

Every theorem in this paper is machine-checked on remote CPU compute (ladder-build-c) under Lean v4.27.0-rc1 with -DautoImplicit=false and -DwarningAsError=true against IndisputableMonolith and Mathlib [25, 26] (base commit e2a3d50b6e2b). Across all 9 library modules and the dedicated audit module EconCore_axioms.lean (Table 6):

- **Scale and hygiene:** 7,737 lines, 495 declarations, 246 public theorems, 0 sorry, 0 admit, 0 custom axiom, 0 native_decide, 0 unsafe, 0 compiler warnings, and 0/35 G5 banned verdict-word hits across every physical-carrier structure field.
- **Exact #print axioms audit (111 audited declarations):**
  - **26 zero-axiom declarations ([]):** econView, miss_dominates, falsePremise_dominates, emp_miss_blocks_empirical_pass, derived_needs_core, econIdRestatementRecord_passes_G3, econG5Scan_clean, econ_blind_tally_verified, all six trap fixtures eg1_smuggling_trapped through eg6_twins_not_confused, econ_closure_status_view, disagreement_has_witness (Thm. 3), identification_of_proposed_code (Cor. 6), relation_determined, and their ActualsPartition instantiations.
  - **14 choice-free declarations ($\subseteq$ {propext, Quot.sound}):** all four domain discrete settling theorems (stock_feasibility_settles_discrete, clearing_zero_sum_settles_discrete, triangular_noArb_settles_discrete, whole_and_seam_verdict_settles_discrete, econ_partition_settles_discrete), the four-live-resource quotient (contextual_minimality, observations_determine_live, resourceQuotientEquiv), one_representative_suffices (Cor. 5), and econ_five_parts_independent.
  - **71 standard-axiom declarations ([propext, Classical.choice, Quot.sound]):** every mounted continuous conservation, clearing, FX J-cost, whole-burden, corporate, seam, rival-disposal, and joint-stack theorem.

8.2 Exact open frontier versus deliberate Choice

Honest boundary accounting keeps three distinct non-forced zones strictly apart:

1. **Deliberate Choice** (`choice_has_two_compatible_laws`, `AdmissibleRival`)**:** Point prices inside $[r_0, r_1]$, agreed positive or zero interest rates, choice between partnership and corporate charter, and statutory written release versus classical consideration (`EB-06`). These are not missing theorems; they are spaces of lawful human and institutional freedom protected by the four-way partition.
2. **Named Open Propositions (`LEAN_CANON.md` compliant, zero custom axioms):**
   - `OpenInformalSignalAttachment`: mapping informal real-world human utterances, contracts, and courtroom testimony into operational signal decoders and counterfactual weights is an empirical coding protocol accountable to blind testing, not a theorem of C_1–C_7.
   - `OpenMacroZipfEmpiricalCalibration`: measuring empirical firm-size and wealth tail indices α_{obs} against the conserved-partition Zipf exponent 1 within pre-registered tolerance bands $\varepsilon > 0$ remains an open empirical comparison target (distinct from the retired SWIFT gpi φ-guess `ECON-MISS-01`).
3. **Exact real-threshold computability and continuation:** Exact unbanded equality on real-valued balances requires omniscience (`C_notSettleable`), whereas declared tolerance bands settle constructively (`C2`). Post-exit continuation (`NoExit` / `PortCanPost`) remains strictly an open physical question for long-run prudential incentives and is never used by any economic or corporate verdict.

8.3 Conclusion

Leaving the economic law unknown and asking what a rival economics must get physically wrong yields a sharper separation than either equilibrium axioms or moralized economics can supply. Mounted on the exact same seven-law physical ledger core (C_1–C_7) as *The Physical Moral Code of Reality*, Actual Economics proves an exact four-way partition into forced Law, genuine Choice, pure Gauge, and run-local History; derives physical stock conservation, the unique unit-free floor 0, four-live-resource minimality, zero-sum claims, cut-space exact J-settlement, equivalence of triangular no-arbitrage and round-trip $J = 0$, zero carrying cost on agreed credit versus positive strain on standing disagreement, conserved-partition Zipf exponent 1, single-charged whole burden with a member-ruin obstruction, corporate port separation with dissolution succession, and clean closure of all three multi-party commercial seams.

All seven major economic rivals (R-E1–R-E7) are disposed of directly in Lean 4 across 7,737 lines (111 audited declarations, 26 zero-axiom, 14 choice-free, 71 `std3`, 0 `sorry`, 0 G5 hits). Held to strictly pre-registered blind testing across 26 stripped disputes (91 questions), the frozen engine records 0 core-law defects, 0 attachment-boundary real misses, 3/3 contested matches on the statutory-release choice seam, 86/88 (97.7%) uncontested passes, and 2 transparent unpatched mechanical lookup misses (`EB-02-Q3`, `EB-11-Q1`) carried permanently alongside retired refusal `ECON-MISS-01` and inherited `MORAL-MISS-01`. Two concrete gates remain open: informal signal parsing and pre-registered empirical calibration of macroscopic Zipf tails.

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