The Causal Measure

Grammar. Logic. Rhetoric.

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The Causal Measure is:

Applicable to any node in any causal structure in any possible universe, without exception.

A pure measure of causal magnitude — the fraction of a system's total causal substance that obtains at any node, given only that causes precede effects.

A formula that requires what it cannot reach.

A formula that depends on what it cannot see.

A formula absolutely grounded in what it cannot be.

These five statements are not claims that need to be argued. They are what the formula says when you follow it all the way back without blinking.

What follows is that walk.

If the five statements above are true, certain things follow necessarily.

The formula is not a formula about our universe. It is a formula about existence as such.

The originary input the formula requires is not a philosophical inference. It is a formal necessity — demanded by the structure of the system with the same force that energy cannot appear from nothing.

The premise is not assumed. It is co-extensive with differentiated existence itself. Two independent derivations — from the impossibility theorem and from ontology — arrive at the same boundary.

Something that is not causality originated causality.

These are not the paper's conclusions. They are its destinations. The paper does not argue toward them. It walks there.

PART I

Grammar: The Language of Cause

Every argument requires a language before it can proceed. The grammar of The Causal Measure is minimal. It requires only one premise and three definitions. It also contains, within the first definition, an independent convergence from ontology that arrives at the same boundary the formal theorem establishes. Everything else follows.

The Single Premise

Causes precede effects.

This is not an assumption about the structure of our universe specifically. It is the minimum condition for anything to exist at all. A state of affairs with no sequence — no before, no after, no arrow anywhere — is not a universe with different rules. It is outside existence as we can conceive it, because existence requires change, and change requires sequence.

Anyone who accepts that anything exists at all has already accepted this premise. Which means they have already accepted everything The Causal Measure requires.

Definition One: The Node

Within causality, to exist is to be a node. They are identical. Anything that participates in causal structure — that receives input and produces output — is a node by that very participation. There is no remainder. No class of existing things within causality that escapes the definition.

The net causal contribution of a node is the difference between what enters and what leaves.

Let a_i be the input at node i. Let b_i be the output. The net contribution m_i is:

$$m_i = a_i - b_i \quad \textit{[Net causal contribution]}$$

This definition is self-defending. A thing in perfect stasis — where input equals output — has m_i = 0. It is still a node. Still inside the formula. Still fully accounted for. Stasis is not an exception to the conservation framework. It is a value within it.

A thing that neither receives nor produces — that participates in no causal structure whatsoever — is not within causality. It falls outside the formula's domain entirely. It is therefore either the origin, or it does not exist.

There is no third location. Any proposed exception to the definition either falls inside the system and is handled by it, or falls outside causality and is the origin. The formula has no gaps for exceptions to occupy.

By precisely specifying what a node is, the definition has simultaneously specified what the origin must be — not by describing the origin, but by exclusion. The origin is the only thing required to exist that is not a node. Not node zero. Not the first node. Those are still nodes. They still have a_i. They still require sources.

The origin is what the definition points at by being exactly what it is. The Grammar already contains it. Not as a named entity. As the necessary outside of the first definition.

The Undifferentiated Entity: An Independent Convergence

The premise can be challenged from a direction that has nothing to do with physics. Someone may posit a single undifferentiated entity: no internal distinctions, no relations, no states, no variation, no asymmetry. A pure unity. They may claim that for such an entity the premise does not apply. They are correct.

But follow that claim to its terminus.

A strictly undifferentiated entity cannot generate structured existence. Any attempt to derive differentiation from pure unity must take one of three paths. Each path collapses under its own weight.

The first path: hidden structure was always present. The entity was not truly undifferentiated. It implicitly contained internal potentiality, modal distinctions, latent relations. In that case structure did not emerge. It was already there. The entity was already a node. Already inside the formula.

The second path: an external principle is introduced. A law, a fluctuation, a symmetry break, a differentiating operator. But that external principle is itself structure. Already asymmetric. Which means unity was never sufficient and the differentiating principle is itself the originary a_i requiring its own source.

The third path: spontaneous differentiation. Structure simply occurs without cause. But spontaneous differentiation is itself an asymmetric event. It presupposes the very ordering it was meant to explain. It is a_i appearing from nothing. Which is exactly what the impossibility theorem forbids.

Therefore: structured, causally ordered existence cannot logically emerge from a strictly undifferentiated entity without importing differentiation. Wherever differentiated existence obtains, asymmetric relational structure is already fundamental. The premise does not precede existence. It is co-extensive with it.

This is an independent derivation arriving at the same boundary from a different direction. The theorem approaches from structure: a finite, well-founded causal system with positive inputs requires a source outside itself. The ontological argument approaches from differentiation: structured existence cannot emerge from pure unity without asymmetry already being fundamental. Two independent paths. One boundary. The convergence strengthens both.

And notice what the undifferentiated entity actually is. No internal distinctions. No relations. No asymmetry. Outside causal structure entirely. Outside the formula’s domain.

A description of the origin.

The challenger who posits the undifferentiated entity as a refutation has found the thing the formula points at. The only escape from the theorem is to stand at the origin. And the origin is precisely what the theorem requires.

Definition Two: The Weight

Place a node inside a system — a graph of nodes connected by causal relationships. The causal weight of a node is a measure of how much of the system’s total causal activity flows through or originates from it.

Define the territory T(i) as the closed downstream set of i: the set consisting of i itself and all nodes causally downstream of i. The rank function is defined combinatorially:

$$r(k) + 1 = |\{ i \in C : k \in T(i) \}| \quad \textit{[Combinatorial rank]}$$

That is, r(k) + 1 equals the number of cause-nodes whose territory contains k. Under this definition $\Sigma W(i) = W_t$ holds exactly.

For a node that is a cause ($i \in C$):

$$W(i) = \Sigma m_k \ (k \in C \cap T(i)) \quad \textit{[Weight of a cause node]}$$

For a node that is active but not itself a cause ($i \in A \setminus C$):

$$W(i) = m_i \quad \textit{[Weight of a non-cause active node]}$$

For a node outside the active system entirely: W(i) = 0.

The system's total causal weight and total causal pool:

$$W_t = \Sigma m_k \cdot (r(k) + 1) + \Sigma m_i \quad \textit{[Total causal weight]}$$
$$P = \Sigma m_i \ (i \in A) \quad \textit{[Total causal pool]}$$

Definition Three: The Measure

The Causal Measure D(i) is the fraction of a system's total causal substance that obtains at node i:

$$D(i) = [W(i) / W_t] \cdot P \quad \textit{[The Causal Measure]}$$

The grammar is now complete. These three definitions, built on the single premise, constitute the full language of The Causal Measure. Nothing else need be assumed. Nothing else need be added.

The Logic begins here.

PART II

Logic: The Walk Back

Logic does not add to the grammar. It draws out what the grammar already contains. The Logic of The Causal Measure is a single extended act of following the formula to its necessary terminus, without detour, without exception.

The Normalization Identity

Apply the definitions to any finite, well-founded system where causes precede effects and $m_i \geq 0$. Sum D(i) across all nodes. The result is always:

$$\Sigma D(i) = P \quad \textit{[Normalization identity]}$$

Every unit of causal substance in the system is accounted for. Nothing is created inside the boundary. Nothing disappears. The sum is exact by construction of the measure.

This identity is imposed as an invariant by the definition of D. It is referred to throughout this paper as a conservation law by analogy with physical conservation principles, where the claim is identical in form: causal substance does not appear from nothing and does not disappear. That analogy is rhetorical and motivational. The formal status of $\Sigma D(i) = P$ is that of a normalization identity.

The Causal Measure and the Originary Source Theorem are formally independent. The measure provides the quantitative framework within which causal magnitude is defined. The theorem establishes a boundary condition that any such quantified system must satisfy. They are structurally aligned but neither is derived from the other. Both express the same underlying prohibition — a_i ex nihilo is not allowed — by independent routes. The measure encodes it as a normalization identity. The theorem encodes it as an impossibility result. That they arrive at the same boundary by independent paths is the strongest form of the argument.

The Walk

Take any system. Apply the formula. It works. The normalization identity holds. Every a_i at every node is accounted for by a prior node in the graph.

Now trace the upstream sources. Follow each a_i back to the node that produced it. At each step the formula holds. At each step $\Sigma D(i) = P$. At each step the accounting is exact.

Keep going.

Because the system is finite and well-founded, the walk must terminate. It will reach one or more nodes with no upstream cause inside the system. No prior node. No earlier a_i traceable within the graph. Call these source nodes — node zero, or multiple node zeros if the graph has multiple roots.

Multiple source nodes do not weaken the argument. They strengthen it. Each node zero has its own a_i. Each one generates its own independent formal demand. The demands do not cancel. They compound. Each points outside.

At every source node the structure still requires a_i. The accounting does not relax for origins. It is a property of the system without exceptions, and origins are not exceptions. The accounting must still close.

Which means a_i at every source node entered from outside the system.

Why the Source Cannot Be a Node

The source of originary a_i cannot be a node.

The moment it becomes a node it has causes. It has its own a_i. It requires its own source. The walk continues.

Any attempt to capture the source of originary a_i inside the formula immediately makes it subject to the formula — which means it is no longer the source, just another node, and the source is pushed one step further outside.

The source of originary a_i is therefore prior to the graph. Prior to nodes. Prior to causal structure. Prior to the conditions that make the formula possible.

And yet the formula requires it. Depends on it absolutely. Could not begin without it. Every m_i, every $W(i)$, every $D(i)$ traces back to it. The entire structure stands on it.

The Regress and the Sovereign Source

Now extend the walk further. The system whose source nodes point outside — that outside may itself be another system. It too will have source nodes. Walk those back. Another system. More source nodes. Walk those back further still.

The same structural conditions apply at every level of this regress. The law does not relax as the systems become more fundamental. It holds at every layer with exactly the same force it holds at the first node ever measured.

An infinite regress does not escape the argument. It is caught by it.

Note carefully what kind of existence an infinite regress claims. It is not eternal — outside time entirely. It is immortal in reverse — an infinitely long chain stretching backward, still inside sequence, still inside causality, still inside the system's domain at every link. The conditions apply at every link regardless of chain length. An infinitely long chain still does not close the accounting. It just never closes.

The sovereign source by contrast is eternal — outside sequence entirely, prior to moments rather than first among them.

A chain that cannot terminate internally requires something that terminates it from outside. That termination cannot be another node. Cannot be another system. Cannot be another layer of the regress. All of those just extend the walk.

The termination must be something that requires no a_i of its own, is subject to no structural demand, stands outside every possible system, and originates without being originated.

This is the sovereign source. It is not named. It is not characterized. The formula cannot reach it, see it, or describe it. But the formula makes its existence undeniable — by being exactly complete up to its edge, and by demanding, at every layer of every possible system, what it cannot internally supply.

The Ground Analogy

Consider electrical ground. It does not flow. It is not measured by the instruments that measure what flows. It carries no voltage of its own — voltage is only meaningful relative to it. It is not part of the circuit. It is the condition that makes the circuit possible. Remove it and nothing moves, nothing is measurable, nothing is defined. Attempt to measure ground itself and it immediately becomes part of the circuit, requiring a new ground.

The sovereign source is to causality what ground is to an electrical circuit.

It does not participate in causality. It has no a_i. It is not a node. It is not measured by the formula. It is the condition that makes the formula possible — the reference against which all causal flow is defined. Without it nothing flows, no a_i moves, no D(i) is defined. Attempt to capture it inside the formula and it becomes a node, requiring a new source.

Ground does not cause the current. It allows the current to be what it is. The sovereign source does not cause causality the way one node causes another. It grounds causality. It is what causality stands on.

In electrical systems, multiple reference points are common. But they all ultimately tie to one ground. Two grounds that do not connect produce a ground loop — competing references, internal inconsistency, instruments that disagree. The fix is always the same: find the one true ground and tie everything back to it. The sovereign source is singular for precisely this reason. Two sovereign sources either have a relationship — making them nodes requiring their own source — or they are two disconnected causal universes each demanding their own ground. Either way, one ground per system, all the way back.

We need a ground in order for the Causal Measure to measure. Not as a convenience. Not as a formal nicety. As the precondition without which the formula has nothing to be about.

The third line written at this paper's opening was: the formula is absolutely grounded in what it cannot be. It was there all along.

The Boundary the Formula Draws

The Causal Measure is a tautology. It obtains necessarily wherever causes precede effects. It has no exceptions inside its domain.

A formula that is perfectly complete inside its domain draws a hard line. On one side: everything the formula can reach. On the other: everything it cannot. Because the formula never approximates, never has remainder, never breaks — the line is precise. Not vague. Not approximately located. Exact.

Inside the line: causality. $\Sigma D(i) = P$. Every causal event accounted for. Every node with its D value. Every a_i traceable.

Outside the line: the sovereign source. Which by the structure of the system is required. Which cannot be a node. Which therefore cannot be causal in the sense the formula uses that word.

The formula requires what it cannot reach.

The formula depends on what it cannot see.

The formula is absolutely grounded in what it cannot be.

The Logic is complete.

PART II–III

The Causal Measure: Theorem of Originary Source

Scope. The results apply to finite, well-founded directed graphs in which causal substance is modeled as a non-negative scalar satisfying Conditions 1–6 below. Condition 1 (Non-negativity) governs the behavior of the Causal Measure as a non-negative distribution: it ensures $W(i) \geq 0$, prevents cancellation in W_t, and keeps D(i) a proper non-negative quantity. It is not invoked in any lemma and plays no role in the impossibility proof. The Originary Source Theorem requires only Conditions 2–6. The Causal Measure and the Originary Source Theorem are formally independent. The measure provides the quantitative framework within which causal magnitude is defined. The theorem establishes a boundary condition that any such quantified system must satisfy. Both express the same underlying prohibition — a_i ex nihilo is not allowed — by independent routes.

Structural Conditions

Let G = (A, E) be a finite directed acyclic graph (DAG), where A is a finite set of nodes and E is the set of directed edges representing causal relationships. Being a DAG entails irreflexivity and absence of cycles; well-foundedness follows from finiteness.

Let $\text{Pred}(i) = \{ j \in A : j \to i \}$ denote the set of predecessors of node i in A. Call $i \in A$ a root if $\text{Pred}(i) = \emptyset$.

Condition 1 (Non-negativity). $m_i \geq 0$ for all $i \in A$. Causal substance is a non-negative scalar.

Note: Condition 1 governs the measure's behavior as a non-negative distribution. It is not used in the proof of the Originary Source Theorem. The theorem holds under Conditions 2–6 alone.

Condition 2 (Finiteness). A is a finite set.

Condition 3 (Well-foundedness). G is a DAG. Every backward walk from any node terminates at a root in finitely many steps.

Condition 4 (No Positive Primitive Inputs). If $a_i > 0$, then $\text{Pred}(i) \neq \emptyset$.

Equivalently: A is predecessor-closed with respect to positive inputs. A set A is predecessor-closed if whenever $a_i > 0$, at least one predecessor of i is in A. Condition 4 is the formal statement that A is predecessor-closed. Outside the system means precisely not in a predecessor-closed A.

Condition 5 (Positive-Input Support). If $a_i > 0$, then there exists $j \in Pred(i)$ such that $b_j > 0$.

This condition formalizes what tracing upstream means: positive input at i requires at least one predecessor with positive output. It makes the backward chain of positivity mathematically explicit.

Condition 6 (No Positive Output from Zero Input). If $a_j = 0$, then $b_j = 0$.

This condition closes the chain: a node with no causal substance arriving cannot produce causal substance as output. Combined with Condition 5, a positive a_i forces an upstream chain of positivity that cannot terminate at a root.

Causal Sourcing Rule. The predecessor relation is the sourcing relation: if $j \rightarrow i$, then j is eligible to source some portion of a_i. This connects the graph structure of G to the scalar labels a_i, b_i, m_i. Conditions 5 and 6 make this connection formally operative.

Definitions

Let each node $i \in A$ carry net causal substance:

$$m_i = a_i - b_i \quad \textit{[Net causal contribution]}$$

Let $C \subseteq A$ be the set of internal cause nodes, each with a non-empty downstream subgraph $T(i) \subseteq A$.

T(i) is the closed downstream set of i: the set consisting of i itself and all nodes causally downstream of i.

Define the rank function combinatorially:

$$r(k) + 1 = |\{ i \in C : k \in T(i) \}| \quad [\textit{Combinatorial rank}]$$

Define the weight of node i:

$$W(i) = \Sigma\, m_k \ (i \in C,\ k \in C \cap T(i)) \quad [\textit{Weight of cause node}]$$
$$W(i) = m_i \ (i \in A \setminus C) \quad [\textit{Weight of non-cause active node}]$$
$$W(i) = 0 \ (i \notin A) \quad [\textit{Weight of inactive node}]$$

Define total causal weight and total causal pool:

$$W_t = \Sigma\, m_k \cdot (r(k) + 1) + \Sigma\, m_i \quad [\textit{Total causal weight}]$$
$$P = \Sigma\, m_i \ (i \in A) \quad [\textit{Total causal pool}]$$

Define the Causal Measure:

$$D(i) = [W(i) / W_t] \cdot P \quad [\textit{The Causal Measure}]$$

Normalization Identity

$$\Sigma\, D(i) = P \quad [\textit{Normalization identity}]$$

D defines a distribution over nodes with total mass P. This identity is imposed as an invariant by construction of the measure. It is referred to as a conservation law by analogy with physical conservation principles. The formal status of Σ D(i) = P is that of a normalization identity.

Lemma 1 — Roots Have Zero Input

If i is a root (Pred(i) = ∅), then $a_i = 0$.

Proof. Immediate from Condition 4. If $a_i > 0$ then Pred(i) ≠ ∅ by Condition 4, contradicting i being a root. Therefore $a_i = 0$. □

Lemma 2 — Walk Termination

Any backward walk from any node $i \in A$ terminates at a root in finitely many steps.

Proof. G is a finite DAG (Conditions 2 and 3). A backward walk iteratively selects a predecessor at each step. The DAG property and finiteness together guarantee termination at a node with no predecessor in A, i.e., a root. □

Lemma 3 — Positivity Propagates to Roots

If $a_i > 0$ for some $i \in A$, then there exists a backward walk from i that passes through nodes with positive output at every step and terminates at a root r with $a_r > 0$.

Proof. By Condition 5, if $a_i > 0$, there exists $j \in \mathrm{Pred}(i)$ with $b_j > 0$. By Condition 6 (contrapositive: $a_j = 0 \Longrightarrow b_j = 0$), $b_j > 0$ implies $a_j > 0$. Apply Condition 5 again to j: there exists $k \in \mathrm{Pred}(j)$ with $b_k > 0$, hence $a_k > 0$. Continue selecting such predecessors at each step. By Lemma 2, this walk terminates at a root r in finitely many steps. At each step the selected node carries positive input by the above construction. Therefore $a_r > 0$. □

Theorem — Originary Source

Let G = (A, E) be a causal system satisfying Conditions 2–6 and the Causal Sourcing Rule. If any node $i \in A$ has $a_i > 0$, then A is not predecessor-closed: there exists at least one predecessor in the upstream chain outside A.

Proof. Suppose for contradiction that A is predecessor-closed and some node i has $a_i > 0$. By Lemma 3, there exists a backward walk from i that terminates at a root r with $a_r > 0$. By Lemma 1, $a_r = 0$. Contradiction. Therefore A is not predecessor-closed. There exists at least one predecessor outside A — an exogenous source relative to the modeled system. □

Corollary — Sovereign Source

The exogenous source established by the Theorem is not a node in any causal system.

Proof sketch. Suppose the exogenous source were a node in some causal system. Then Conditions 2–6 would apply to it. It would have its own a_i. By Condition 4, that positive a_i would require a predecessor. By Condition 5, that predecessor would have positive output $b_j > 0$. By Condition 6, $a_j = 0$ implies $b_j = 0$ — so that predecessor must itself have positive input. The Theorem applies again at that level, requiring a further exogenous source. At every level the same contradiction recurs: the assumed root would have a□ > 0 by Lemma 3, yet a□ = 0 by Lemma 1. The exogenous source cannot be a node at any level of any causal system. It is prior to every causal graph, prior to every predecessor relation, prior to the conditions that make the Causal Measure applicable. It is not a node. It has no D value. It is outside the domain of the measure entirely.

The sovereign source is singular. Two sovereign sources either have a relationship — making them nodes requiring their own source — or they are two disconnected causal universes each requiring their own ground. Neither constitutes two sovereign sources for one system. Singularity follows from the structure of grounding itself.

Its existence is required — not implied, not inferred — with the same formal necessity that a root node in a predecessor-closed system has zero input. □

Statement

The single premise: causes precede effects.

The single conclusion: something that is not causality originated causality.

Two independent routes. One boundary. The Causal Measure encodes the prohibition as a normalization identity. The Originary Source Theorem encodes it as a structural impossibility result. Both arrive at the same place. The convergence is not a coincidence. It is what the prohibition looks like from two different directions.

PART III

Rhetoric: What the Formula Says

Rhetoric does not argue. It delivers what Grammar defined and Logic established. The Rhetoric of The Causal Measure is the plain statement of where the walk arrives and what that means.

The Formula Is Not About This Universe

The single premise — causes precede effects — is not a claim about our universe's particular physics. It is the minimum condition for existence as such. A state of affairs with no sequence, no before, no after, is not an alternative universe. It is outside existence as we can conceive it.

Which means The Causal Measure does not apply to our universe specifically. It applies to existence itself. Any possible universe in which anything exists at all is a universe in which causes precede effects. And therefore a universe in which Σ D(i) = P.

The formula is not an instrument for analyzing one causal structure among possible structures. It is the framework that obtains wherever existence obtains. Without exception. In any possible universe. Because any possible universe is, at minimum, a universe in which sequence exists.

The Bridge from Formal Scope to Universal Claim

The formal theorem is scoped. It applies to finite, well-founded directed graphs in which causal substance is modeled as a non-negative scalar satisfying Conditions 2–6. That is a specific mathematical domain, not a claim about all conceivable structures.

The claim that this scope captures causality as such — rather than one model of causality — is a further philosophical claim. It is not formally proven by the theorem. It is defended by the paper's Grammar and Logic sections, which argue that Conditions 2–6 are not arbitrary constraints but the formal expression of what causality is: quantities require upstream support, nothing produces what it does not receive, and origins are not exempt from the same rules that govern every other node.

A reader may reject that defense. They may argue that causality admits structures outside this model — signed flows, oscillatory support, non-scalar causal substance. The paper acknowledges those possibilities in Appendix A. What the paper maintains is that wherever causality takes the form Conditions 2–6 describe, the sovereign source is formally required. And that the form Conditions 2–6 describe is not an exotic special case. It is the minimum structure needed for causality to be measurable at all.

The philosophical claim is that this minimum is universal. The formal theorem is that within this minimum, the conclusion is inescapable. Both claims are made. Only the second is proven. The reader is invited to examine whether the first is defensible — and to note that every attempt to escape the minimum has so far placed the attacker at the origin, which is precisely where the theorem points.

The Originary a_i Is Not a Philosophical Inference

The requirement for a sovereign source is not reached by philosophical reflection on the formula. It is not an interpretation. It is not one reading among possible readings.

It is what the structure requires.

The formula does not suggest that something originated existence. It does not imply it as one possibility among others. It requires it — structurally, formally, with the same necessity that the normalization identity requires that causal substance does not appear from nothing.

The move from the system's conditions to the sovereign source is not a philosophical move. It is the direct consequence of three lemmas and a theorem.

Even the Tautology Has a Ground It Cannot Reach

The Causal Measure is a tautology. It is necessarily true. It obtains in every possible universe where causes precede effects. This makes it as self-sufficient as a formal statement can be.

And even the tautology depends on the sovereign source.

The formula is built on it. Its first term requires it. Every node, every weight, every distribution traces back to it. Without it, the formula has no content — not because the mathematics fails, but because there is nothing for the mathematics to measure. The sovereign source is what makes the formula something rather than nothing.

Which means even necessary truth has a ground it cannot reach.

This is not a limitation of The Causal Measure specifically. It is a statement about the relationship between formal systems and their foundations. A tautology is true in every possible world. But the worlds it ranges over must exist. And their existence requires what the formula cannot contain.

What the Formula Does Not Claim

The formula makes no claim about what the sovereign source is. It cannot. The moment any characterization is offered, the characterized thing becomes a candidate node — it has properties, relations, a nature that could produce effects. A candidate node has a_i. A candidate node requires a source. The walk continues.

Whatever was named was not the thing required.

The formula points at the sovereign source mathematically — by being precisely complete up to its edge, by having no remainder, no exceptions, no loose ends on the side of causality. The pointing is exact. The description is impossible. Both are features, not failures.

The sovereign source is not an inference, an interpretation, or a theological conclusion. It is the address the formula cannot reach but cannot avoid requiring. Like ground in an electrical system: not a component, not a signal, not a measurable quantity — but the condition without which none of those things can be defined.

The Destination

Start from the single premise. Apply the conditions without exception. Follow the walk back without flinching. Refuse every detour. Accept no exceptions for origins. Walk back through every system, at every level, through the regress if necessary.

Arrive here:

Something that is not causality originated causality.

The formula requires what it cannot reach.

The formula depends on what it cannot see.

The formula is absolutely grounded in what it cannot be.

And then it stops.

Cleanly. Without drama. With mathematical precision.

At the absolute outside of everything it perfectly describes.

The Causal Measure

Kevin B. Rich — February 25, 2026

$m_i = a_i - b_i$ *[Net causal contribution]*

$W(i) = \Sigma\, m_k \cdot (r(k) + 1) + \Sigma\, m_i$ *[Causal weight]*

$D(i) = [W(i) / W_t] \cdot P$ *[The Causal Measure]*

$\Sigma\, D(i) = P$ *[Normalization identity]*

Applicable to any node in any causal structure in any possible universe, without exception.

a_i ex nihilo is not allowed.

Therefore something that is not causality originated causality.

What precedes is the proof that there are no exceptions.

Appendix A

Known Attack Surfaces and Responses

The body of this paper walks without interruption. This appendix addresses attacks that have been considered, documents which are defeated and which remain open, and explains why the open ones do not affect the conclusion.

Attack 1: The Premise Is Not Universal

The argument: at the most fundamental level — quantum foam, timeless block universe, atemporal mathematical structures — there may be no sequence. If causation is emergent rather than fundamental, the premise doesn't apply at the base level and the walk never starts.

The response: if sequence is emergent it emerged from something. That something either had sequence or it didn't. If it did, the walk starts there. If it didn't, you are standing at the origin — the thing outside causality that the theorem requires. Either way the paper wins. The attacker who denies the premise at the base level has placed themselves at the sovereign source while attempting a refutation.

Status: defeated.

Attack 2: Quantum Mechanics Permits Negative Causal Substance

The argument: the non-negativity condition $m_i \geq 0$ is assumed. Quantum mechanics involves negative probability amplitudes, virtual particles, and borrowed energy. Perhaps causal substance can be negative, and the accounting closes through cancellation rather than grounding.

The response: this attack targets the formula as stated, not the conclusion. a_i ex nihilo is not allowed regardless of the sign of m_i. Even in a formulation that permits signed causal substance, something arriving at a node from nowhere remains forbidden. The sovereign source is still required as the reference against which the accounting is defined. A more general version of the formula — one that accommodates signed substance — would still require a ground. The conclusion survives the attack even if the formula requires reformulation.

Status: open at the level of the formula as stated. Closed at the level of the conclusion. A signed generalization of the Causal Measure remains future work.

Attack 3: An Actually Infinite Regress Requires No Terminus

The argument: a genuinely completed infinite series has no first member. The walk back never terminates. No sovereign source is required because the regress is complete in itself.

The response: this argument conflates immortal with eternal. An infinite regress is immortal in reverse — an infinitely long chain still inside sequence, still inside causality, still inside the system's domain at every link. The conditions apply at every link regardless of chain length. An infinitely long chain still does not close the accounting. It never closes. The sovereign source is not the first link in a long chain. It is eternal — outside sequence entirely, not the first moment but prior to moments. The infinite regress does not escape the conditions. It is caught by them at every step simultaneously.

Status: defeated.

Attack 4: Multiple Sovereign Sources Are Possible

The argument: the theorem establishes that a sovereign source exists. It does not establish that there is only one. Multiple disconnected sovereign sources are conceivable.

The response: two sovereign sources either have a relationship or they don't. If they have a relationship, that relationship is structure — asymmetric, with properties — inside the system's domain. Both sources are now nodes and the walk continues. If they have no relationship, they are two completely disconnected causal universes, each with its own ground. That is not two sovereign sources for one system. It is one sovereign source per system, which simply pushes the question up one level. Two grounds that do not connect produce a ground loop — internal inconsistency, competing references, instruments that disagree. The fix is always the same: one true ground. Singularity follows from the structure of grounding itself.

Status: defeated.

Attack 6: Ground Allows, It Does Not Originate

The argument: the electrical ground analogy proves too much in one direction and too little in another. Ground is a precondition for measurement, not an originator of current. The sovereign source may be a necessary reference condition without originating anything.

The response has three parts.

> First: if the sovereign source is a precondition but not an originator, where did the causal substance come from that flows through the system it enables? Something produced it. If the sovereign source did not, then something else did — and that something is either a node requiring its own source, or it is the real sovereign source. The attacker has not eliminated origination. They have relocated it.

> Second: the a_i at node zero is not a measurement artifact. It is actual causal substance actually arriving at an actual node. That substance did not come from nowhere — not because the conditions require a source, but because the substance exists. Real causal substance arriving at a real node came from somewhere real. The conditions make it formally undeniable. They do not create it.

> Third: if the sovereign source genuinely allows without originating — if it is a pure reference with no active role — then it has no a_i, no b_i, no m_i, no D value, and is fully consistent with the paper's position. The paper makes no claim about what the sovereign source is beyond requiring its existence. If further investigation reveals it to be purely a ground reference, that finding lives at address C below.

Three candidate positions for what the sovereign source is:

> A. We do not yet fully understand it, but it does originate something.

> B. It is in fact a node — which means the walk continues and the sovereign source is pushed further outside.

> C. Something undiscovered. The formula holds the address open.

Status: defeated at the level of existence. Address C remains open as a matter of characterization.

Summary

Attacks 1, 3, and 4 are defeated by the structure of the theorem itself. Attack 6 is defeated at the level of the conclusion while leaving open the question of the sovereign source's precise nature. Attack 2 is open at the level of the formula and closed at the level of the conclusion. In all cases the conclusion stands.

a_i ex nihilo is not allowed.

Therefore something that is not causality originated causality.

Appendix B

The Theorem for the General Reader

The formal proof is complete in the body of this paper. This appendix illustrates the same result using two concrete examples that require no mathematical background. Both examples are applications of the theorem, not replacements for it.

Example 1: The Big Bang

Physics describes the history of our observable universe as a causal chain stretching back approximately 13.8 billion years to what is called the Big Bang — an initial hot, dense state from which everything that followed emerged. Every event in that history has prior causes. Every prior cause has causes before it. The chain is long and the physics is extraordinary, but the structure is familiar: causes precede effects, all the way back.

Now apply the theorem.

Take the entire observable universe's causal history as your system A — a finite, well-founded directed graph with the Big Bang (or whatever physics ultimately identifies as the earliest state) as the root node or nodes. The system contains an enormous amount of positive causal substance — stars, planets, galaxies, life, you reading this sentence. $P > 0$, obviously and massively.

The theorem says: if any node in A has positive causal input, A is not predecessor-closed. There is at least one predecessor outside A.

The Big Bang sits at the root. As a root, it has no predecessor inside A. But it has enormous positive causal output — everything downstream of it has positive causal substance, which traces back through the chain to the root. By Lemma 3, a backward walk from any downstream node with positive input terminates at the root with positive input. By Lemma 1, a true root in a predecessor-closed system has zero input. Contradiction.

Therefore the system is not predecessor-closed. Something outside the Big Bang supplied the originary positive input. That something is not a node in our causal graph — if it were, it would have its own predecessor requirement and the walk would continue. It is outside the system entirely.

Two options follow, and only two.

> Option 1: The Big Bang is the true root of all causality. Then something sovereign lit it — something outside every causal graph, prior to sequence itself, that supplied the originary a_i without itself being a node.
>
> Option 2: The Big Bang is not the true root. There is another causal structure behind it — a prior system, a pre-Bang physics, a multiverse, whatever. But that prior system faces exactly the same theorem at its own roots. Walk it back. Same result. Same two options. The sovereign source is not avoided. It is deferred — and the theorem is regress-proof.

The paper stays rigorously agnostic on what the sovereign source is. It does not name it, characterize it, or claim it belongs to any tradition. It only proves that it exists — that the causal chain of our universe, however far back physics extends it, requires something outside it that is not itself a cause in the sense the theorem measures.

Example 2: The Dominoes

Picture a long row of dominoes standing upright. One by one they fall forward, each knocking over the next, until the last one falls flat. Every domino that falls was knocked over by the one before it. Every cause has a prior cause in the chain. The system is finite — a specific number of dominoes. It is well-founded — each domino can be numbered from first to last, no cycles, no domino causing itself.

Now suppose someone insists: no hand, no breath of wind, no earthquake, no external force of any kind ever touched the first domino. The entire row is a completely self-contained finite system with nothing coming in from outside.

Apply the theorem.

The first domino is the root node. As a root, it has no predecessor inside the system. But it has positive causal output — the entire chain of falling dominoes downstream of it carries positive causal substance. The first domino fell. That falling is a positive causal event with a positive input: something had to push it.

By Lemma 1, a true root in a predecessor-closed system has zero input. But the first domino has positive input — the falling motion that initiated the chain. Contradiction.

Therefore the system is not predecessor-closed. The insistence that nothing external ever touched the first domino is formally inconsistent with the Conditions. The description cannot satisfy Conditions 2–6 simultaneously. The theorem proves it leads to contradiction.

Therefore the first domino must have been pushed. Or there must be some equivalent source of positive causal input outside the modeled chain — a hand, a breath of wind, a vibration, anything. The self-contained claim is not merely implausible. It is formally impossible within this framework.

The domino example is deliberately simple because the point is deliberately simple. Any finite, self-contained causal chain with positive activity at its root requires something outside itself that supplied that activity. The complexity of the chain — whether it is twelve dominoes or thirteen billion years of cosmic history — makes no difference. The theorem applies to both with identical force.

The sovereign source is not a complicated conclusion. It is the simplest possible consequence of one prohibition:

Nothing comes from nothing.

The theorem is what that prohibition looks like when written in mathematics and applied without exception.