

Bitcoin as Unique Neutral Settlement: A Seven-Property Elimination

Sean Hash

bitcoingametheory.com

sean@bitcoingametheory.com

February 2026

Working Paper

JEL Codes: G11, G12, G15, D82, E42, E51, L14

Keywords: Bitcoin, neutral settlement, asset comparison, digital scarcity, reserve assets, capital allocation, property elimination, game theory, network effects

Abstract

Which asset can serve as neutral settlement in a multipolar world? The companion paper (Hash, 2026a) establishes that the payoff advantage of Exit over Stay is monotone increasing in adoption, and derives seven necessary properties: protocol security, neutrality, permissionless access, cheap finality, absolute scarcity, informational security, and adaptive resilience. This paper applies those properties. We conduct a systematic elimination across seven asset classes — fiat currencies, sovereign bonds, equities, real estate, gold, alternative blockchain tokens, and Bitcoin — showing that each traditional class violates at least one required property. Bitcoin satisfies all seven, not because it is perfect on any single dimension, but because it is the only asset with an empty capture surface. We support the elimination with empirical data: \$170 billion in ETF assets under management within two years (institutional adoption cascades), \$1 billion settled for under \$500 in fees (settlement efficiency), and total hashrate recovery within six months of China’s comprehensive ban (network resilience). The analysis also explains why Bitcoin’s position derives from an unreplicable historical sequence rather than technical superiority alone, making the network effect argument structural rather than contingent. The analysis does not require fiat collapse — Bitcoin operates as settlement finality layer in parallel with fiat payment rails.

1. Introduction

The Exit Game (Hash, 2026a) proves that the payoff advantage of moving capital from capturable settlement systems to neutral settlement is monotonically increasing in adoption.

But the framework is agnostic about *which* asset serves as the Exit destination. It derives seven necessary properties (P1-P7) and shows that the Exit advantage is monotone increasing — but the identity of the neutral settlement asset is an empirical question, not a theoretical one.

This paper answers that question. We take P1-P7 as given and ask: which existing asset satisfies all seven simultaneously? The answer is reached by elimination, not by advocacy. Each asset class is tested against each property. Six classes fail. One survives.

The structure is deliberate. By separating the game-theoretic argument (Paper 1) from the asset identification (this paper), we make the logic auditable: a reader who rejects our claim about Bitcoin need only show that some alternative satisfies P1-P7, without engaging the game theory. A reader who accepts Bitcoin’s properties need only verify the elimination table, without reconstructing the dominance proof.

2. The Property Framework

We summarize the seven properties derived in Hash (2026a), Section 3.3. Each property blocks a specific attack class that would violate neutral settlement (Definition 1: immune to seizure, debasement, and political capture).

2.1 Formal Specifications

P1 (Protocol Security). Mining constitutes a Nash equilibrium; attack cost exceeds expected gain. Formally: $C_{\text{attack}} + P_{\text{collapse}} > \Delta_{\text{attack}}$, and $\sum \hat{t} \cdot E[\Pi_{\text{honest}}] > \Delta_{\text{attack}} - C_{\text{attack}}$ (following Budish, 2018 and Biais et al., 2019).

P2 (Neutrality). No issuer, no foundation, no governance mechanism capable of unilateral rule changes. $|CS| = 0$.

P3 (Permissionless Access). Any agent can initiate settlement without third-party permission. $\Pr(\text{censor access} \mid \text{scale}) = 0$.

P4 (Cheap Finality). Settlement of \$1 billion for fees below \$500, with mathematical finality in under 60 minutes.

P5 (Absolute Scarcity). Fixed supply with zero supply elasticity: $dS/dP = 0$.

P6 (Informational Security). Custody is mathematical (private key knowledge). Cost of seizure scales superlinearly with targets.

P7 (Adaptive Resilience). Protocol upgrades via consensus without introducing governance capture.

2.2 Necessity and Sufficiency

Proposition 1 (Necessity). P1-P7 are individually necessary. Removing any single property enables the corresponding attack vector. (Proved in Hash, 2026a.)

Proposition 2 (Sufficiency). P1-P7 are jointly sufficient. Candidate additional properties either reduce to P1-P7 (e.g., “privacy” reduces to P6) or introduce non-structural criteria that would create capture surface, violating P2.

3. Elimination

3.1 Method

For each asset class, we identify which properties are violated and the mechanism of violation. An asset fails the test if it violates *any* single property, since P1-P7 are individually necessary.

3.2 Results

Asset Class	Properties Violated	Mechanism
C1: Fiat/CBDCs	P2, P5	Issuers can debase (supply elasticity > 0) and surveil/censor transactions
C2: Sovereign Bonds	P5	Negative real yield under financial repression; denominated in debaseable currency
C3: Equities	P2	Subject to regulatory capture (margin requirements, trading halts, dilution)
C4: Real Estate	P3, P6	Illiquid, physically seizable, subject to property tax and eminent domain

Asset Class	Properties Violated	Mechanism
C5: Gold	P4, P6	Settlement friction of 3-8% (insurance, transport, assay); physically seizable
C6: Alt-L1 tokens	P2	Governance capture via foundation treasuries, VC voting blocs, or proof-of-stake concentration
C7: Bitcoin	None identified	—

3.3 Detailed Analysis

C1: Fiat Currencies and CBDCs. Central banks set monetary policy to serve domestic objectives (Assumption 1). The supply schedule is discretionary: $dS/dP = 0$ by design. This violates P5 directly. CBDCs add programmable censorship (violating P3) and state surveillance (violating P6). No fiat currency has maintained purchasing power over a 50-year horizon against hard assets.

C2: Sovereign Bonds. Bonds are claims on future fiat. When the underlying currency is debased, bondholders bear the loss through negative real yields. Financial repression — holding interest rates below inflation — is the observed mechanism. This is not a market failure; it is policy working as intended. Real yields on 10-year US Treasuries were negative for 26 of 36 months from 2020-2023 (Federal Reserve Bank of St. Louis, FRED series DGS10 minus T10YIE).

C3: Equities. Productive assets generate real returns but are subject to regulatory capture. Governments can impose capital controls, windfall taxes, forced sales, trading halts, and beneficial ownership reporting requirements. The capture surface is large: $|CS_{equities}| > 0$.

C4: Real Estate. Property is the paradigmatic *seizable* asset. Eminent domain, property tax, and zoning regulation constitute permanent capture surfaces. Physical location is known (violating P6). Settlement requires title search, escrow, and legal process (violating P4). Cross-border real estate settlement is measured in weeks, not minutes.

C5: Gold. This is the hardest case and deserves extended treatment. Gold has served as

neutral settlement for millennia. It fails on two properties: P4 (settlement friction) and P6 (seizure). Physical gold settlement incurs 3-8% costs including insurance, transport, assay, and storage (BullionVault, 2025). The 3,000-16,000x efficiency gap versus Bitcoin settlement reflects the fundamental difference between physical and informational assets. Executive Order 6102 (1933) demonstrated that gold is seizable at national scale.

The verification game. Gold settlement embeds a verification game that has no Bitcoin analogue. Model the interaction between a seller (S) delivering an asset claimed to be gold and a buyer (B) who must decide whether to verify:

	S: Authentic	S: Forge
B: Trust	$(V - P, P)$	$(-V, V + P)$
B: Verify	$(V - P - C_V, P)$	$(-C_V, -C_F)$

where V is the asset value, P is the price, C_V is verification cost, and C_F is forgery cost. The equilibrium depends on the relationship between C_V and C_F .

For gold, C_V is **monotone increasing in forgery sophistication**: spray-painted lead is caught by visual inspection ($\sim \$0$), but tungsten-core bars require destructive assay (2-5% of bar value) or ultrasound testing ($\$200$ - 500 /bar). Documented cases include tungsten-core bars in commercial LBMA inventories and spray-painted lead bars in retail markets. The US gold reserve at Fort Knox has not been independently audited since 1953 — even sovereign-scale verification is prohibitively costly.

Lemma (Verification Cost Asymmetry). Let $C_V^{\{gold\}}(s)$ be the cost of verifying gold against a counterfeiter of sophistication $s \in [0, 1]$. Let $C_V^{\{btc\}}$ be the cost of verifying a Bitcoin UTXO. Then:

- (i) $C_V^{\{gold\}}(s) > 0$ — gold verification cost increases with forgery sophistication.
- (ii) $C_V^{\{btc\}} = 0$, independent of attacker sophistication (under Assumption 3, computational hardness).
- (iii) Gold verification is non-persistent: each transfer resets the verification game (the bar could have been swapped). Bitcoin verification is persistent: a confirmed UTXO remains valid until spent.

Proof. (i) follows from the physical structure of gold: detecting surface-level fakes (visual) costs less than detecting deep fakes (destructive assay). More sophisticated forgeries require more invasive — and more expensive — testing. (ii) follows from Assumption 3: verifying a digital signature is computationally trivial regardless of the attacker’s resources (the attacker

cannot produce a valid signature without the private key). (iii) follows from the difference between physical and informational assets: a physical bar’s composition can change between inspections; a UTXO’s validity is determined by the blockchain state, which is globally consistent and tamper-evident.

The implication for autonomous agents is categorical: an AI agent verifying gold must either trust a human intermediary (introducing counterparty risk at $r = 0$) or deploy physical inspection infrastructure (humanoid robots, automated assaying machines) whose calibration itself depends on human trust chains. Bitcoin verification requires only a full node — software the agent controls entirely.

The gold-ETF objection. Gold ETFs (GLD, IAU) settle digitally at low cost, arguably satisfying P4. But gold ETFs are claims on custodial gold, not gold itself — they introduce counterparty risk (the custodian) and regulatory capture (the issuer). An ETF can be frozen, diluted, or restructured by its sponsor. If we accept ETF wrappers as satisfying P4, then by the same logic Bitcoin ETFs satisfy P4 — and the underlying asset remains the object of analysis, not the wrapper. Gold’s P4 and P6 failures are properties of gold-as-settlement, not gold-as-financial-product.

C6: Alternative L1 Tokens. Every alternative blockchain protocol has at least one of: a foundation treasury that constitutes a governance capture surface, a venture capital allocation that creates concentrated voting power, or a proof-of-stake mechanism in which wealth concentration maps directly to protocol control. Ethereum’s transition to proof-of-stake in September 2022 made this explicit: the largest stakers have proportional influence over block production and transaction ordering.

The stablecoin objection. Stablecoins (USDC, USDT) and tokenized treasuries settle digitally at low cost and denominate in familiar units, arguably satisfying P4. But stablecoins fail P2 and P5 by construction. The issuer maintains a freeze function — Tether has frozen hundreds of addresses at the direction of law enforcement agencies, totaling over \$1 billion as of 2025. This means $|CS_stablecoin| > 0$: a single entity can unilaterally alter settlement outcomes for any address. Stablecoins also fail P5: they are denominated in fiat currency, so the underlying asset debases when the reference currency debases — the holder bears debasement risk with none of the yield. The capture is not hypothetical: proposed US stablecoin legislation (2025-2026) would cap yield payments to holders below market rates, a provision secured through banking industry lobbying to protect deposit bases. This is the P2 failure mode in its clearest form: a political coalition altering the asset’s rules to serve incumbent interests, precisely the capture that Definition 1 requires immunity from.

C7: Bitcoin. Bitcoin satisfies all seven properties. P1 is supported by the mining Nash equilibrium (Biais et al., 2019). P2 holds because there is no issuer, no foundation, and $|CS|$

= 0. P3 is demonstrated by the network’s continued operation across every jurisdiction that has attempted to ban it. P4 is empirically verified (\$1B settled for <\$500). P5 is algorithmic (21 million cap, enforced by node consensus). P6 follows from cryptographic custody. P7 is demonstrated by the soft fork upgrade path (SegWit, Taproot) without governance capture.

3.4 Coexistence

The elimination does not require fiat collapse. Bitcoin operates as superior collateral and settlement finality in parallel with fiat payment rails. The cascade pressure (Hash, 2026a, Proposition 2) applies to the reserve settlement function. Fiat retains payment and unit-of-account roles — potentially indefinitely. This is not a revolutionary claim; it is a structural one.

4. Empirical Support

Theory without data is speculation. The following observations are consistent with the framework.

4.1 Institutional Adoption

Spot Bitcoin ETFs accumulated \$61.5 billion in net inflows since January 2024, reaching approximately \$170 billion in total AUM. BlackRock’s IBIT crossed \$97 billion in 435 days — faster than any ETF in history (The Block, 2025). This is consistent with the cascade dynamics predicted by the Exit Game: institutional actors crossing their adoption thresholds p_i^* in clusters.

4.2 Sovereign Behavior

El Salvador holds 7,529 BTC with daily purchases and geothermal mining (Bitcoin Treasuries, 2025). Singapore issued 13 digital payment token licenses in 2024 (MAS, 2024). Argentina received \$91.1 billion in cryptocurrency value amid 143% inflation (Chainalysis, 2024). These observations are consistent with sovereign defection from the Stay coalition (Hash, 2026a, Theorem 2).

4.3 Settlement Efficiency

Bitcoin settles \$1 billion in value for fees typically under \$500 with mathematical finality in under 60 minutes (Mempool.space, 2024). Gold settlement incurs 3-8% friction costs

(BullionVault, 2025). This 3,000-16,000x gap is the empirical basis for the P4 elimination of gold.

4.4 Network Resilience

China’s comprehensive mining ban in 2021 resulted in total hashrate recovery to all-time highs within six months (CCAF, 2022). Bitcoin’s hashrate reached approximately 700 EH/s in 2025, with no PoW competitor exceeding 1% of this security budget (CCAF, 2025).

4.5 Historical Uniqueness

Bitcoin’s position derives from an unreplicable historical sequence: (1) pure origin (no ICO, no pre-mine, no venture capital, no foundation treasury — Nakamoto, 2008), (2) founderless development (creator departed, estimated 1.1 million BTC unspent since 2009 — Lerner, 2019), (3) survival of six categories of existential crisis without protocol failure, and (4) PoW hashrate dominance following Ethereum’s migration to proof-of-stake in 2022.

No competitor can replicate this sequence. As Huberman, Leshno, and Moallemi (2021) observe, Bitcoin is a “monopoly without a monopolist” — and the monopoly derives from the *absence* of a monopolist, not despite it. A new protocol with a known founder, a foundation treasury, and venture backing fails P2 by construction, regardless of its technical merits.

5. Discussion

5.1 The Gold Question

Gold is the strongest competitor and deserves extended treatment. Gold has served as neutral settlement for millennia. Its failure on P4 and P6 is not a deficiency of gold but a consequence of its physicality. The information revolution created a new possibility: settlement that is mathematical rather than physical, where custody requires knowledge rather than location.

Krugman (2018) argues that Bitcoin lacks fundamental value because it has no tether to economic activity. This is reasonable if you weight intrinsic yield over settlement properties. The present analysis weights structure — and on structure, gold fails two properties that Bitcoin satisfies.

Taleb (2021) makes a different case: that Bitcoin is fragile because it depends on continuous mining, electricity, and internet infrastructure. This is the steelman for P7 failure. Our response: seventeen years of operation through six categories of existential crisis (exchange failures, regulatory bans, mining exodus, protocol disputes, market crashes, and sustained

negative press) constitute empirical evidence for P7, though not proof. The fee-transition risk (Carlsten et al., 2016) remains the strongest version of Taleb’s concern.

5.2 Attack Survival

The elimination holds only if Bitcoin actually satisfies P1-P7. The most serious challenge is sovereign attacks: can state actors ban, seize, or suppress Bitcoin?

The steelman: a coordinated coalition — G7 plus China — simultaneously criminalizing possession, enforcing through ISP-level filtering, and imposing secondary sanctions. The defense rests on three structural features. Informational security (P6) transforms seizure into a key-management problem. Permissionless access (P3) redirects activity rather than eliminating it — as China’s 2021 ban empirically demonstrated. And the coalition itself is unstable: the first defector captures fleeing capital, and coordination problems are precisely what this paper series is about.

We regard F1 — permanent single global coordinator — as the most plausible falsification path. Not because it is likely, but because it is the only attack that does not face a game-theoretic self-undermining dynamic.

5.3 The Volatility Objection

Bitcoin’s annualized volatility has exceeded 70% in multiple calendar years, with drawdowns exceeding 50% from all-time highs occurring in 2014, 2018, 2022, and again in early 2026 (approximately 52% decline from cycle highs). This is the most common objection from traditional finance practitioners and deserves direct treatment.

Volatility is not among P1-P7. This is deliberate: volatility is a market phenomenon, not a structural property of the protocol. The Exit Game model (Hash, 2026a, condition M2) posits that $_B'(p) < 0$ — deeper markets reduce volatility. The long-term trend is consistent with this: Bitcoin’s 90-day realized volatility has declined from ~150% in 2011 to ~45% in 2024. However, the empirical evidence is mixed. Sharp drawdowns persist at current adoption levels. The power law channel (price following a power law of time since genesis) describes the central tendency but does not constrain short-term deviations.

We therefore distinguish two claims. The *structural* claim: volatility affects adoption timing (through the $_i \cdot _B(p)$ term) but not equilibrium structure. More risk-averse actors have higher thresholds p_i^* and wait longer. This holds regardless of $_B$ ’s sign. The *empirical* claim: volatility will decrease with adoption as markets deepen. This is plausible but unproven at current adoption levels, and the 2026 drawdown is a direct counterexample

to the naive version. M2 should be understood as a long-run tendency, not a monotone empirical fact at every time horizon.

5.4 Settlement vs. Acceptance

The elimination framework rests on a distinction that deserves explicit treatment: *settlement* is not *acceptance*.

Settlement in Bitcoin is a cryptographic fact. A valid signature transfers value from address A to address B. The protocol does not ask who owns the addresses, whether the transaction serves a lawful purpose, or whether the receiving party will be able to spend the output. At the protocol layer, P3 (permissionless access) holds unconditionally.

Acceptance is a social fact. If address B is associated with a sanctioned entity — a designation maintained by OFAC, the EU, or other authorities — then exchanges and custodians will refuse to credit incoming funds from B or any address that received value from B. The coins are settled but economically impaired: their acceptance by regulated counterparties depends on off-chain arbitration that the protocol cannot control.

This creates a race condition. Mixing services, coinjoins, and cross-chain bridges attempt to break the provenance chain. Compliance tools (Chainalysis, Elliptic) attempt to trace it. The effectiveness of both evolves continuously. Partial laundering creates a spectrum of “cleanliness” rather than a binary clean/tainted classification, and gray-market exchanges accept coins that regulated exchanges reject.

For our analysis, the implication is: P3 guarantees settlement at the protocol layer, but the *economic utility* of that settlement depends on the post-settlement acceptance environment. The elimination holds for settlement functionality — Bitcoin is the unique asset where the *protocol* imposes no barriers. Whether the *ecosystem* around the protocol adds barriers is a compliance question, not a settlement one. This distinction is sharpened in Hash (2026c), where autonomous agents face the compliance problem in its purest form.

The Acceptance Game. The settlement-acceptance distinction produces a natural enforcement equilibrium without requiring protocol-level censorship. Consider an actor receiving coins of uncertain provenance. The expected payoff of blind acceptance is:

$$E[\text{Accept}] = V - p \cdot d(t) \cdot c$$

where V is the value of the coins, p is the probability of taint, $d(t)$ is the probability of detection at time t , and c is the cost of punishment (legal penalties, reputational damage, asset seizure). Acceptance is rational when $V > p \cdot d(t) \cdot c$.

Three features distinguish this game from the cash analogue. First, $d(t)$ is monotonically increasing: Bitcoin’s permanent ledger means chain analysis capabilities improve over time

and apply retroactively to past transactions. Coins accepted today may be flagged in 2030. Cash has no such property — once spent, provenance is lost. Second, regulated entities (exchanges, custodians) face c values that dominate V for any realistic taint probability — license revocation, criminal liability, institutional collapse — and these entities control the fiat on/off ramps. Third, the resulting “provenance discount” on tainted coins reduces the economic payoff of the underlying crime: you can steal Bitcoin, but you cannot easily convert it at par value.

The equilibrium stratifies by actor type:

Actor	d (detection)	c (punishment)	Filtering
Regulated exchange	High	Very high	Mandatory
Individual (KYC'd)	Medium	High	Incentivized
AI agent	Medium	Low (no personhood)	Rational (near-zero analysis cost)
Gray market	Low	Low	Minimal

Notably, the actors most capable of filtering (regulated exchanges) are also the actors most severely punished for failure, creating robust enforcement at the fiat conversion bottleneck. For autonomous agents, filtering converges to near-perfection not from moral obligation but from the trivial cost of on-chain provenance analysis relative to any nonzero expected punishment.

The policy implication: protocol-level censorship (violating P2 and P3) is unnecessary for enforcement, because the application layer produces its own enforcement equilibrium through rational acceptance decisions. Bitcoin’s neutrality at the settlement layer is compatible with — indeed, strengthened by — discretionary filtering at the acceptance layer.

5.5 Limitations

The elimination is as strong as the property framework. If P1-P7 are incomplete — if there exists an eighth necessary property that Bitcoin violates — the elimination fails. The sufficiency argument (Proposition 2) addresses this, but sufficiency proofs are inherently harder than necessity proofs because they require exhaustive enumeration of alternatives.

On minimality and completeness. We claim that P1-P7 are individually necessary and jointly sufficient. We do not claim they are *minimal* — that is, that no proper subset of P1-P7 suffices. Formal minimality would require showing that for each property P_k, there exists an asset satisfying all P_j (j ≠ k) that fails as neutral settlement. The counterexamples are suggestive (Ethereum for P1, Solana for P2, CBDCs for P3, gold for P4, commodity bonds for P5, Swiss banking for P6, Litecoin for P7) but a rigorous minimality proof — in the tradition of axiomatic characterizations in social choice (Arrow, 1951) and mechanism design (Gibbard, 1973) — would require 7-10 additional pages and is not attempted here. The relevant question for the elimination is necessity + sufficiency: can an asset fail any single property and still serve as neutral settlement? The answer is no, and that is what the framework proves.

Seventeen years of data is brief for a monetary claim. Gold has millennia. The response — that the relevant properties are structural, not historical — is logically sound but empirically untested at the timescales that matter. Carlsten et al.’s (2016) analysis of the fee-only security budget is particularly relevant: the transition from block subsidies to fee-only security is the largest untested structural assumption, and it will not be resolved by theory alone.

6. Conclusion

The elimination is complete. Among seven asset classes tested against seven necessary properties, six classes fail at least one property. Bitcoin fails none. This is not a claim about superiority on any single dimension — gold is more historically tested, equities generate higher short-term returns, fiat currencies are more liquid for daily payments. The claim is narrower: Bitcoin is the only existing asset with an empty capture surface that simultaneously satisfies all requirements for neutral settlement.

The companion paper (Hash, 2026a) proves that the payoff advantage of Exit over Stay is monotonically increasing. This paper identifies the destination. A third paper (Hash, 2026c) extends the analysis to the case where the convergence pressure is strongest: autonomous agents with zero legal recourse.

References

- Arrow, K. J. (1951). *Social Choice and Individual Values*. John Wiley & Sons.
- Biais, B., Bisiere, C., Bouvard, M., and Casamatta, C. (2019). The blockchain folk theorem. *Review of Financial Studies*, 32(5), 1662-1715.
- Bitcoin Treasuries (2025). Sovereign Bitcoin holdings tracker. bitcointreasuries.net.

- Budish, E. (2018). The economic limits of Bitcoin and the blockchain. *NBER Working Paper* No. 24717.
- BullionVault (2025). Gold settlement cost analysis.
- Cambridge Centre for Alternative Finance (2022). Cambridge Bitcoin Electricity Consumption Index: China mining ban impact.
- Cambridge Centre for Alternative Finance (2025). Cambridge Bitcoin Electricity Consumption Index: Global hashrate data.
- Carlsten, M., Kalodner, H., Weinberg, S. M., and Narayanan, A. (2016). On the instability of Bitcoin without the block reward. *Proceedings of the 2016 ACM SIGSAC*, 154-167.
- Chainalysis (2024). The 2024 Geography of Cryptocurrency Report.
- Federal Reserve Bank of St. Louis (2024). FRED Economic Data: 10-Year Treasury minus inflation expectations (DGS10, T10YIE series).
- Gibbard, A. (1973). Manipulation of voting schemes: A general result. *Econometrica*, 41(4), 587–601.
- Huberman, G., Leshno, J. D., and Moallemi, C. (2021). Monopoly without a monopolist. *Review of Financial Studies*, 34(7), 3266-3302.
- Krugman, P. (2018). Transaction costs and tethers: Why I’m a crypto skeptic. *The New York Times*, July 31.
- Lerner, S. (2019). The return of the deniers and the revenge of Patoshi.
- Mempool.space (2024). Bitcoin transaction fee and settlement data.
- Monetary Authority of Singapore (2024). Digital Payment Token Licensing Statistics.
- Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system.
- Hash (2026a). Bitcoin exit dominance in monetary coordination games. Working paper, bitcoingametheory.com.
- Hash (2026c). Settlement at zero trust: Bitcoin and autonomous economic agents. Working paper, bitcoingametheory.com.
- Taleb, N. N. (2021). Bitcoin, currencies, and fragility. *Quantitative Finance*, 21(8), 1249-1255.
- The Block (2025). Bitcoin ETF AUM tracker.