Token Economics (Tokenomics)

Lesson 5: The Economics of Digital Tokens

Prof. Joerg Osterrieder

Spring 2026

Learning Objectives

After this lesson, you will be able to:

- Define tokens and distinguish different token types
- Explain token supply mechanics (minting, burning)
- Analyze token distribution models
- Evaluate tokenomics for project sustainability

Prerequisites: Lessons 1-4 (Intro, Blockchain, Crypto, Consensus)

Token

is the study of how tokens create and capture value

Lesson Outline

1. What Are Tokens?
2. Token Supply Mechanics
3. Token Distribution
4. Token Valuation
5. Designing Good Tokenomics

Disclaimer

Educational Purpose Only

This course is for **educational purposes only** and does not constitute investment, financial, or legal advice.

- Do not make investment decisions based solely on course content
- Cryptocurrency investments carry significant risk of loss
- Consult a licensed financial advisor before investing
- Past performance does not guarantee future results

Alway

conduct your own research and seek professional advice

What Are Tokens?

Tokens vs. Cryptocurrencies

Cryptocurrency (Native Coins):

- Run on own blockchain (Bitcoin, Ethereum)
- Used to pay transaction fees
- Incentivize network security

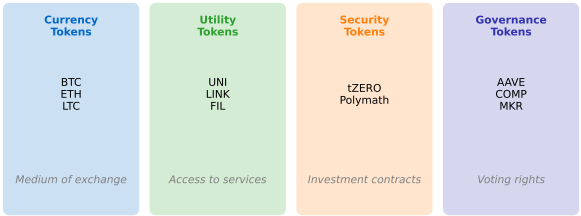
Tokens:

- Built on existing blockchains (e.g., ERC-20 standard on Ethereum)
- Created via smart contracts
- Represent various assets or utilities

Note: ERC-20 is the technical standard for fungible tokens on Ethereum, defining functions like transfer, balance checking, and allowances. **Key Difference:** Coins are protocol-level, tokens are application-level.

ETH is a coin; USDC and UNI are tokens on Ethereum

Token Classification



Differ

token types serve different purposes and have different regulatory implications

Utility Tokens

Definition: Tokens that provide access to a product or service.

Characteristics:

- Not designed as investments
- Value tied to platform usage
- Often required to use the service

Examples:

- **BAT** (Basic Attention Token): Pay for ads, reward users
- **FIL** (Filecoin): Pay for decentralized storage
- **LINK** (Chainlink): Pay oracle nodes for data

tokens are like arcade tokens: needed to play, not investments

Security Tokens

Definition: Tokens that represent ownership or investment contracts.

Characteristics:

- Subject to securities regulations
- Represent equity, debt, or revenue shares
- Often have dividends or profit sharing

The Howey Test (US):

1. Investment of money
2. In a common enterprise
3. With expectation of profits
4. From efforts of others

Secu

tokens must comply with SEC regulations in the US

Governance Tokens

Definition: Tokens that grant voting rights in protocol decisions.

What Holders Can Vote On:

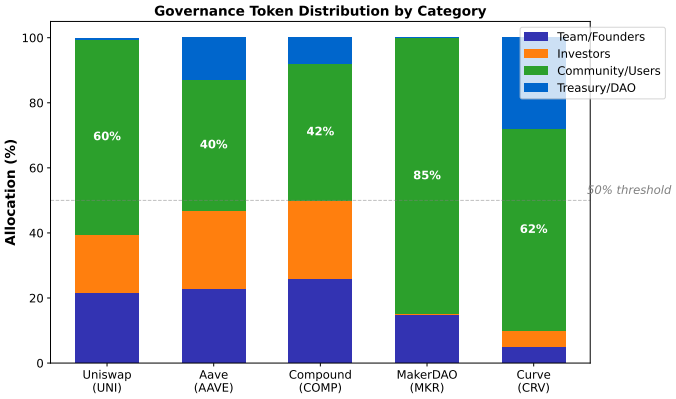
- Protocol upgrades
- Fee structures
- Treasury spending
- Parameter changes

Examples:

- **UNI** (Uniswap): Vote on protocol fees, grants
- **AAVE**: Vote on risk parameters, listings
- **MKR** (MakerDAO): Vote on collateral types, rates

tokens decentralize decision-making

Governance Token Distribution



Comm

allocation is key for decentralization; team tokens typically vest over 3-4 years

NFTs: Non-Fungible Tokens

Definition: Unique tokens representing ownership of specific items.

Fungible vs. Non-Fungible:

- Fungible: Interchangeable (1 ETH = 1 ETH)
- Non-fungible: Unique (this specific artwork)

Use Cases:

- Digital art and collectibles
- Gaming items and virtual land
- Tickets and access passes
- Real estate tokenization

enable digital scarcity and provenance

Token Supply Mechanics

Supply Fundamentals

Key Metrics:

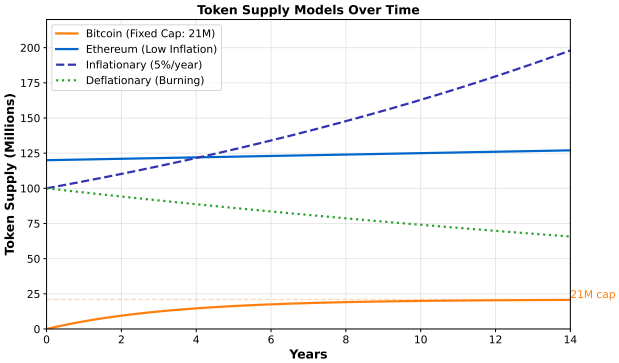
- **Total Supply**: All tokens ever created
- **Circulating Supply**: Tokens currently tradeable
- **Max Supply**: Hard cap on total tokens possible

Examples:

- Bitcoin: 21 million max supply (fixed)
- Ethereum: No max supply (inflationary, with burning)
- Dogecoin: No max supply (perpetual inflation)

mechanics directly impact token value and inflation

Token Supply Models



Differ

supply models create different economic incentives

Fixed Supply (Deflationary)

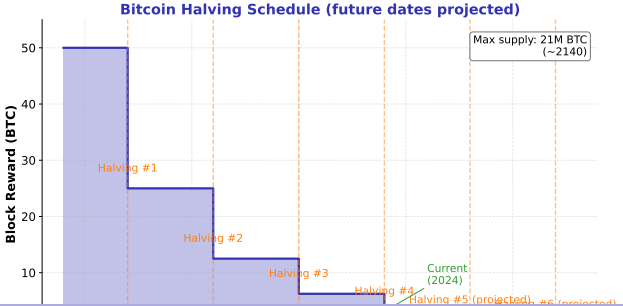
Characteristics:

- Hard-coded maximum supply
- No new tokens can be created
- Scarcity increases over time

Bitcoin's Approach:

- 21 million BTC maximum
- Block reward halves every 210,000 blocks (4 years)
- Last Bitcoin mined around year 2140

Economics: If demand grows, price must rise (no supply expansion).



Inflationary Models

Characteristics:

- New tokens continuously created
- Used to fund network security/staking rewards
- Dilutes existing holders over time

Controlled Inflation:

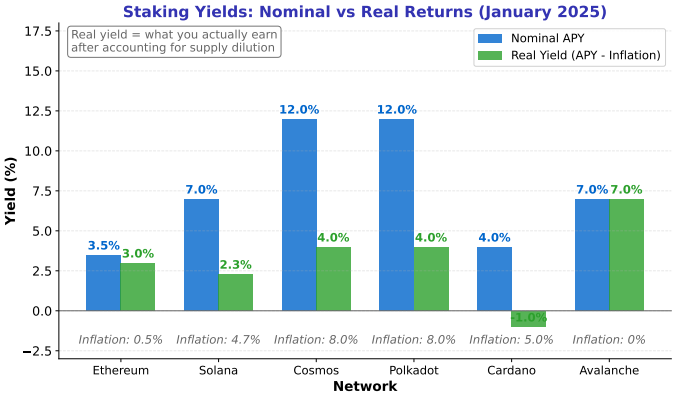
- Ethereum PoS: 0.5% annual inflation
- Cosmos: 7-10% inflation (max reduced via governance)
- Polkadot: 8% inflation (reduced from 10% in 2024)

Trade-off: Security rewards vs. value dilution.

Inflat

incentivizes participation but must be balanced

Staking Yields: Nominal vs Real



Alway

compare real yield (after inflation) when evaluating staking opportunities

Understanding Staking Economics

Nominal Yield:

- Advertised APY/APR from staking
- What you earn in tokens

Real Yield:

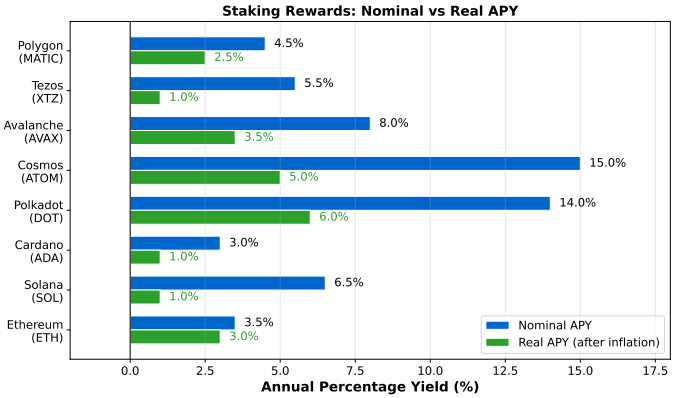
$$\text{Real Yield} = \text{Nominal Yield} - \text{Inflation Rate}$$

Example (Cosmos):

- Nominal APY: 15%
- Inflation: 10%
- Real Yield: 5%
- Non-stakers diluted by 10%/year

rewards often compensate for inflation rather than create new value

Staking Rewards Across Networks



Sourc

StakingRewards.com – Higher nominal APY often comes with higher inflation

Token Burning

Definition: Permanently removing tokens from circulation.

Methods:

- Send to unspendable address (burn address)
- Smart contract burns automatically
- Buyback and burn programs

Examples:

- **EIP-1559**: Ethereum burns base fees (Over 3.5 million ETH burned since August 2021)
- **BNB**: Binance quarterly burns until 100M remains
- **SHIB**: Community burns to reduce supply

Burni

creates deflationary pressure

Ethereum's Burn Mechanism

EIP-1559 (August 2021):

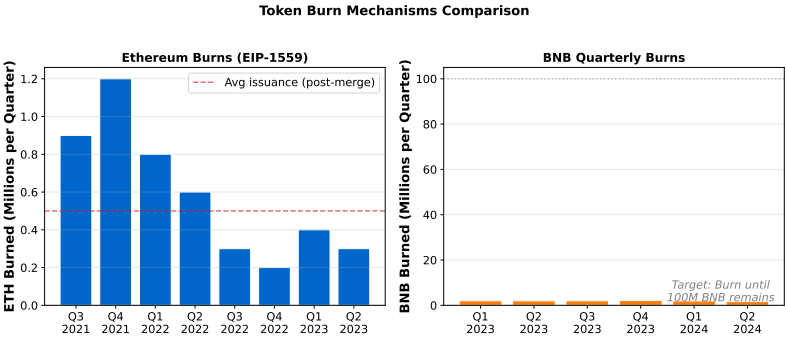
- Base fee burned, tips go to validators
- When usage high: more burned than issued
- "Ultrasound money" when net deflationary

Impact:

- Over 3.5 million ETH burned since August 2021
- Net issuance often negative
- Creates buy pressure during high activity

can be inflationary or deflationary depending on usage

Token Burn Mechanisms Compared

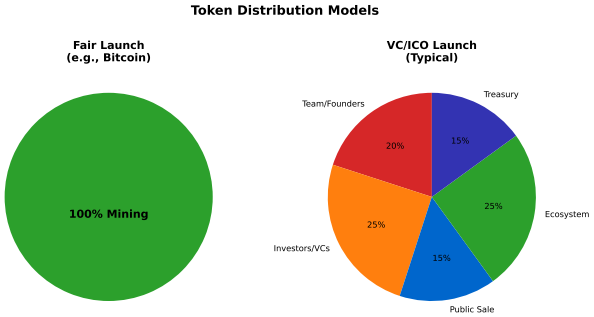


Sourc

Etherscan, BscScan – Burns create deflationary pressure on supply

Token Distribution

Distribution Models



Initia

distribution significantly impacts long-term decentralization

Fair Launch

Characteristics:

- No pre-mine, no pre-sale
- Everyone starts equal (mining or staking)
- Most decentralized approach

Examples:

- **Bitcoin**: Satoshi mined alongside everyone else
- **Dogecoin**: No pre-mine, community distributed
- **Monero**: Fair launch, privacy-focused

Trade-off: Fair, but no funding for development team.

Fair launches prioritize decentralization over team funding

Token Generation Event (TGE)

Definition: The moment when a project's tokens are first created and distributed.

Key Characteristics:

- Also called "Token Launch" or "Token Sale Event"
- Marks the initial distribution to investors, team, and community
- Critical milestone in a project's lifecycle
- Often only a fraction of total supply is unlocked at TGE

TGE vs. Full Token Supply:

- TGE unlock: 5-20% of total supply (typical)
- Remaining tokens locked under vesting schedules
- Large TGE unlocks (>20%) can cause price volatility

Unde

TGE unlock percentage is crucial for assessing initial sell pressure

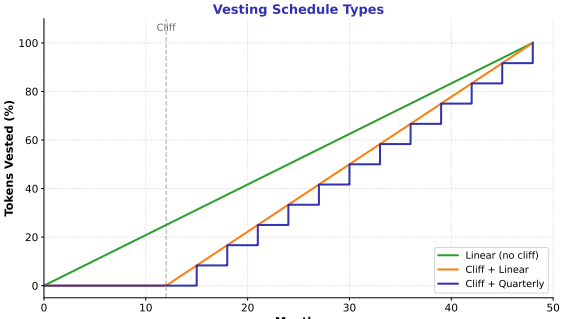
Pre-mine and Allocation

Common Allocation Categories:

- **Team/Founders**: 15-25% (with vesting)
- **Investors**: 10-20% (seed, private, public)
- **Treasury/Foundation**: 10-20% (grants, development)
- **Community**: 40-60% (airdrops, rewards, mining)

Vesting Schedules:

- Lock tokens for 1-4 years
- Gradual release (monthly/quarterly)
- Prevents immediate dumping



Initial Coin Offerings (ICOs)

The 2017-2018 ICO Boom:

- Projects raised billions via token sales
- Many projects failed or were scams
- Led to regulatory crackdowns

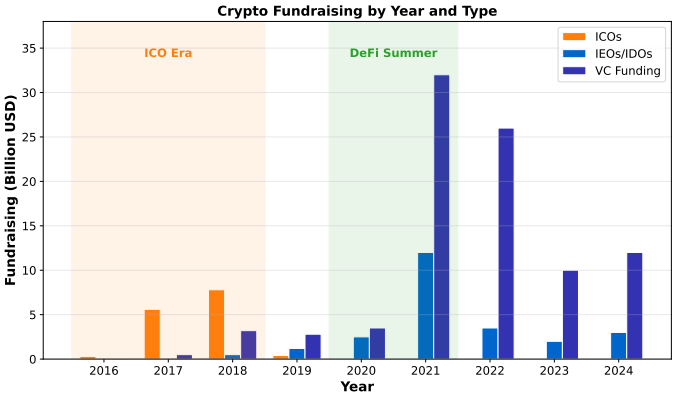
Why ICOs Failed:

- No accountability or deliverables
- Unrealistic promises
- Tokens dumped immediately after launch

Legacy: Showed need for better distribution mechanisms.

ICO mania led to modern approaches like IEOs, IDOs, and airdrops

Crypto Fundraising Timeline



Sourc

ICODrops – VC funding now dominates over public token sales

Airdrops

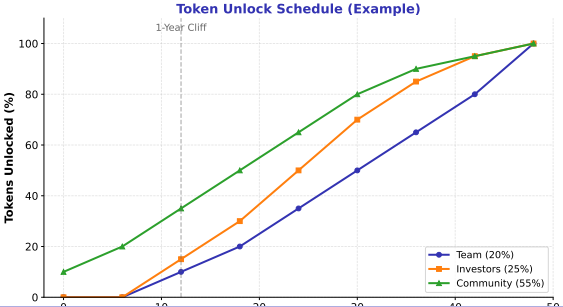
Definition: Free distribution of tokens to wallet addresses.

Types:

- **Holder airdrops**: Based on existing holdings
- **User airdrops**: Reward past platform users
- **Promotional airdrops**: Marketing distribution

Famous Airdrops:

- **Uniswap (UNI)**: 400 UNI to each user ($1,200+)
- **ENS**: Based on domain registration history
- **Optimism (OP)**: Multi-criteria user rewards



Liquidity Pools: Foundation for LP Tokens

What is a Liquidity Pool?

- Smart contract holding reserves of two (or more) tokens
- Enables decentralized trading without order books
- Users trade against the pool, not other users
- Used by DEXs like Uniswap, SushiSwap, PancakeSwap

How Pools Work:

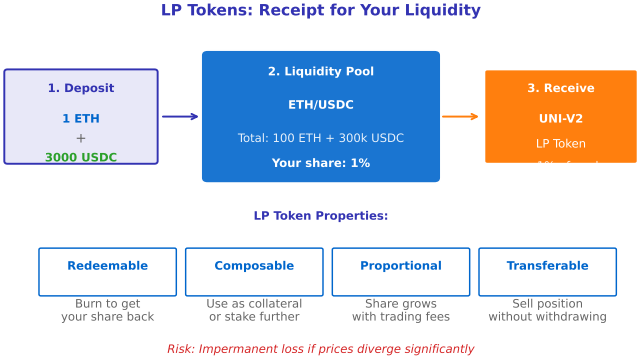
- Automated Market Maker (AMM) maintains constant product: $x \times y = k$
- Traders swap tokens, paying 0.3% fee (typical)
- Fees distributed proportionally to liquidity providers

Why Provide Liquidity?

- Earn trading fees passively
- Support ecosystem (reduce slippage for traders)
- Risk: **Impermanent loss** if prices diverge

pools are the foundation of DeFi—LP tokens represent your share

LP Tokens: Receipts for Liquidity



LP tokens represent your share of a liquidity pool—a key DeFi primitive

LP Token Mechanics

How LP Tokens Work:

- Deposit equal value of two tokens (e.g., ETH + USDC)
- Receive LP tokens proportional to your share
- LP tokens accrue trading fees automatically
- Burn LP tokens to withdraw underlying assets

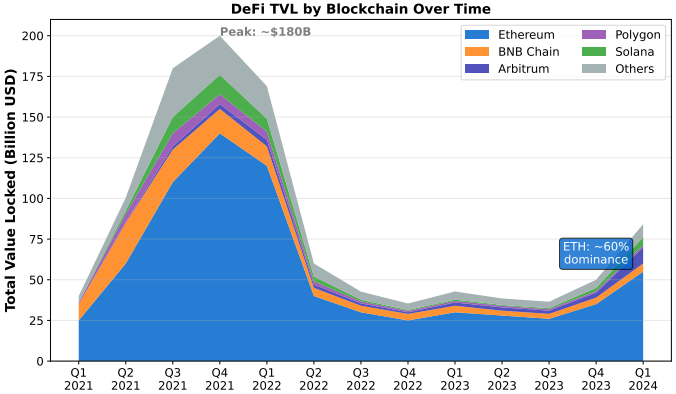
LP Token Composability:

- Use as collateral in lending protocols
- Stake in **yield farms** (protocols offering extra token rewards) for additional rewards
- Trade or transfer without withdrawing liquidity

Caution: Impermanent loss (IL)—the temporary loss compared to holding tokens separately when prices diverge—can exceed trading fees earned.

LP tokens enable "money legos"—composing DeFi protocols together

DeFi TVL by Blockchain



Sourc

DeFiLlama – Ethereum maintains dominance but L2s and alt-L1s growing

Token Valuation

Market Capitalization

Formula:

$$\text{Market Cap} = \text{Price} \times \text{Circulating Supply}$$

Fully Diluted Valuation (FDV):

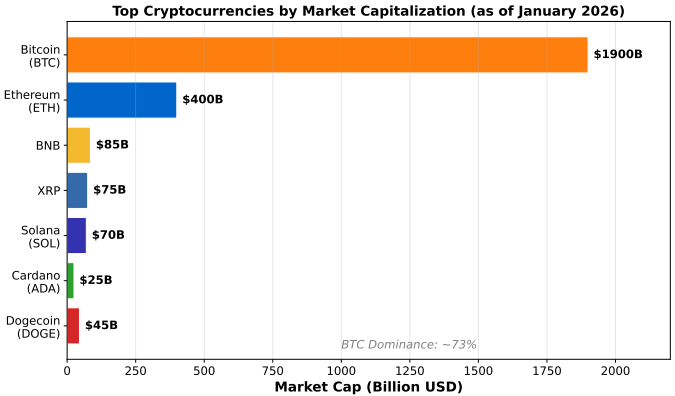
$$\text{FDV} = \text{Price} \times \text{Max Supply}$$

Why FDV Matters:

- Low circulating supply can inflate market cap
- FDV shows potential dilution
- Compare FDV to market cap to assess inflation risk

Low market cap / high FDV = significant future dilution

Top Cryptocurrencies by Market Cap



Sourc

CoinGecko – Bitcoin dominance typically ranges 40-60% of total market

Token Velocity

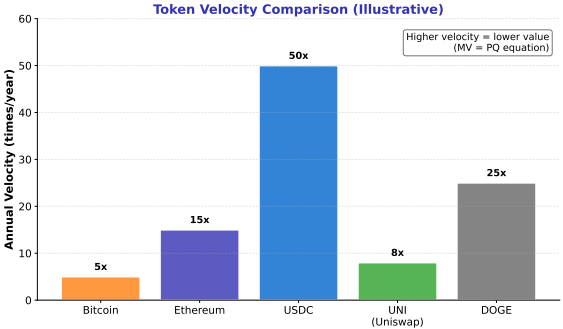
Concept: How frequently tokens change hands.

Velocity Equation (from MV = PQ):

$$\text{Price} = \frac{\text{Transaction Volume}}{\text{Velocity} \times \text{Supply}}$$

Problem:

- High velocity = tokens don't need to be held
- Users buy, use, sell immediately
- Reduces price appreciation



Value Accrual Mechanisms

How Tokens Capture Value:

- **Fee sharing**: Revenue distributed to holders
- **Buybacks**: Protocol buys and burns tokens
- **Staking rewards**: Yield for locking tokens
- **Governance power**: Voting on valuable decisions

Examples:

- MKR: Buyback and burn from stability fees
- CRV: **veCRV** (vote-escrowed CRV—locked CRV with voting power) earns trading fees + **bribes** (incentives paid to voters to direct rewards)
- GMX: 30% of fees to stakers

Stron

value accrual = sustainable token demand

Designing Good Tokenomics

Red Flags in Tokenomics

Warning Signs:

- Team allocation $> 30\%$ without long vesting
- No clear utility or value accrual
- Short vesting periods (< 1 year)
- High FDV relative to market cap
- No token burn or sink mechanisms

Questions to Ask:

- Why does this project need a token?
- What happens to tokens after use?
- Who benefits from token appreciation?

Many tokens exist only to raise money, not create value

Case Study: Good Tokenomics

Ethereum (ETH):

- Required for all transactions (gas)
- Staking secures the network (3-5% yield)
- EIP-1559 burns fees (deflationary pressure)
- Governance via improvement proposals

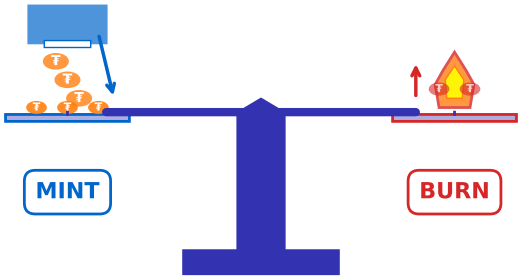
Why It Works:

- Multiple reasons to hold
- Supply responds to demand (burn)
- Clear utility at protocol level

ETH

has strong tokenomics due to essential utility and burn mechanism

Token Supply Equilibrium



Supply = Mint Rate - Burn Rate

Key Takeaways

What You Learned Today:

1. Token types: utility, security, governance, NFT
2. Supply: fixed vs. inflationary vs. burning
3. Distribution: fair launch, pre-mine, airdrops
4. Valuation: market cap, FDV, velocity

Core Insight: Good tokenomics align incentives between users, developers, and investors through carefully designed supply, distribution, and utility.

Next lesson: Decentralized Finance (DeFi)

Questions for Reflection

1. Why might a project choose inflationary tokenomics?
2. What makes an airdrop effective vs. wasteful?
3. How does token velocity affect price?
4. What questions would you ask before investing in a token?

Discussion: Should all crypto projects have tokens?

Note: Question 4 is for educational analysis only. This course does not provide investment advice.

Consi

these questions before our next session

Data Sources

Where to Find Token Data:

- CoinMarketCap: Market cap, price, supply data
- Messari: Token profiles, fundamentals, governance
- Token Terminal: Protocol revenue, fees, P/F ratios
- CoinGecko: Token categories, comparisons
- Dune Analytics: Custom on-chain queries and dashboards

Additional Resources:

- Token.unlocks.app (vesting schedules)
- Ultrasound.money (Ethereum burn tracker)
- DefiLlama (TVL, protocol metrics)

Alway

cross-reference data from multiple sources

Thank You

Questions?

Course materials: digital-ai-finance.github.io/crypto-economics

Appendix: Case Studies & Deep Dives

Case Study: Bitcoin Halvings

What is a Halving?
Every 210,000 blocks (4 years), Bitcoin block rewards cut in half.

Halving History:

- 2009: 50 BTC per block (Genesis)
- 2012: 25 BTC per block (First halving)
- 2016: 12.5 BTC per block
- 2020: 6.25 BTC per block
- 2024: 3.125 BTC per block (April 2024)
- 2028: 1.5625 BTC per block (expected)

Economic Impact:
Supply shock + constant/growing demand = historical price increases 12-18 months post-halving.

Halvi

create predictable supply shocks—core to Bitcoin's "digital gold" narrative

Technical: Vesting Schedules Deep Dive

Common Vesting Structures:

- **Linear vesting**: Equal amount released monthly
- **Cliff + linear**: 1-year cliff, then monthly releases
- **Milestone-based**: Tokens unlock on deliverables

Example (Typical VC Investment):

- 10% allocation to VCs
- 1-year cliff (no tokens for 12 months)
- 3-year linear vesting after cliff
- Total: 4 years until fully unlocked

Red Flags:

- No cliff (immediate selling possible)
- Short vesting (<2 years)
- Large TGE unlock (>20% at launch)

Check

vesting schedules on token.unlocks.app before investing

Technical: Token Velocity Problem

Equation of Exchange (MV = PQ):

$$M \times V = P \times Q$$

Rearranging for price level:

$$P = \frac{M \times V}{Q}$$

Where: M = money supply, V = velocity, P = price level, Q = transaction volume

The Problem:
If velocity (V) is high, price (P) must be low for same transaction volume.

High Velocity Scenario:

- Users buy token, use immediately, sell
- No holding pressure
- Token acts as "hot potato"

Solutions to Reduce Velocity:

- Staking rewards (incentivize holding)
- Governance rights (power requires holding)
- Fee discounts for holders
- Burn mechanisms

Great protocol usage doesn't guarantee token value if velocity is high

Warning: Recognizing Unsustainable Tokenomics

Classic Ponzi Token Signs:

- Yields >100% APY with no revenue source
- "Rewards" paid from new depositor funds
- Complex rebasing/elastic supply mechanics
- Anonymous team with no accountability

Questions to Ask:

1. Where do the yields come from?
2. What happens if new deposits stop?
3. Is the token required for the product?
4. Who benefits from token appreciation?

Historical Examples:

- OlympusDAO forks (most collapsed 90%+)
- Anchor Protocol (20% yields, collapsed with Terra)
- Various "SafeMoon" clones

If yield seems too good to be true, it probably is