L39: Case Study - Terra/Luna Collapse

Module E: DeFi Ecosystem

Blockchain & Cryptocurrency

December 2025

Learning Objectives

- Understand the Terra/Luna mechanism (UST stablecoin + LUNA token)
- Analyze the Anchor Protocol's 20% APY promise
- Trace the death spiral timeline (May 2022)
- Identify systemic risks and warning signs
- Extract lessons for DeFi stability and sustainability

Terra Ecosystem Overview

Key Components:

- **UST (TerraUSD):** Algorithmic stablecoin pegged to $1
- **LUNA:** Native token of Terra blockchain, used to stabilize UST
- **Anchor Protocol:** Lending platform offering 20% APY on UST deposits
- **Terra Blockchain:** Layer 1 built on Cosmos SDK

Creator: Do Kwon (Terraform Labs)

Peak Market Cap (April 2022):

- UST: $18 billion
- LUNA: $40 billion
- Combined: $58 billion ecosystem

Collapse (May 2022): Both UST and LUNA went to near-zero in 72 hours.

The UST-LUNA Mechanism

Algorithmic Stability: UST maintains $1 peg through arbitrage with LUNA.

Mechanism:

1. **Mint UST:** Burn $1 of LUNA, mint 1 UST
2. **Burn UST:** Burn 1 UST, mint $1 of LUNA

Arbitrage Examples:
If UST ¿ $1 (e.g., $1.05):

- Burn $1 LUNA, mint 1 UST
- Sell 1 UST for $1.05
- Profit: $0.05 per UST
- Effect: UST supply increases, price falls back to $1

If UST ¡ $1 (e.g., $0.95):

- Buy 1 UST for $0.95
- Burn 1 UST, mint $1 LUNA
- Profit: $0.05 per UST
- Effect: UST supply decreases, price rises back to $1

The Fatal Flaw

Problem: Mechanism only works if LUNA has value.

Death Spiral Logic:

1. UST depegs below $1 (e.g., $0.90)
2. Arbitrageurs burn UST, mint LUNA
3. Massive LUNA supply increase (dilution)
4. LUNA price crashes
5. Confidence in UST collapses (if LUNA worthless, UST unbacked)
6. More UST selling, deeper depeg
7. Cycle repeats, accelerating downward

Analogy: Like a central bank defending currency by printing more currency (hyperinflation).

Critical Insight: Pure algorithmic stablecoins have no demand floor. Once confidence breaks, irrecoverable.

Anchor Protocol: The 20% APY Trap

Promise: Earn 20% APY by depositing UST.

How It Worked:

- Users deposit UST into Anchor
- Anchor lends UST to borrowers (collateralized by staked LUNA, ETH)
- Borrowers pay interest (10-15%)
- **Gap:** Anchor subsidized difference to reach 20% (unsustainable)

Subsidy Source:

- Terraform Labs treasury (LUNA token sales)
- Yield Reserve (depleting over time)

Red Flag:

- Yield reserve burning $50-100M per month
- Projected to run out by mid-2022
- Community votes to reduce APY rejected

Why 20% APY Was Unsustainable

Math Doesn't Add Up:

Anchor's Revenue:

- Borrow interest: 12% APY on \$4B borrowed = \$480M/year
- Other income: Minimal

Anchor's Expenses:

- Deposit interest: 20% APY on \$14B deposited = \$2.8B/year

Annual Deficit:

$$\$2.8B - \$480M = \$2.32B \text{ shortfall}$$

Conclusion: Anchor was a Ponzi-like scheme. New deposits paid old depositors until subsidy ran out.

Warning Sign: No sustainable business model can pay 20% in a low-rate environment.

Timeline: The Collapse (May 7-12, 2022)

May 7-8: Initial Depeg

- Large UST withdrawals from Anchor ($2B+ in 48 hours)
- Curve 3pool (UST/USDC/USDT) imbalanced
- UST briefly drops to $0.98

May 9: Panic Begins

- UST falls to $0.92
- $1B UST burned, minting billions of LUNA
- LUNA price drops 30% ($80 → $60)

May 10: Death Spiral Accelerates

- UST at $0.60
- LUNA supply balloons (100M → 1B tokens in hours)
- LUNA price collapses ($60 → $1)

May 11-12: Total Collapse

- UST at $0.10, then $0.01
- LUNA at $0.0001 (6.5 trillion tokens in circulation)
- Terra blockchain halted

The Numbers: Destruction of Value

Pre-Collapse (Early May 2022):

- UST market cap: \$18B
- LUNA market cap: \$40B
- Anchor deposits: \$14B
- Total ecosystem: \$60B

Post-Collapse (Mid-May 2022):

- UST value: \$0 (99%+ loss)
- LUNA value: \$0 (99.9%+ loss)
- Estimated losses: \$40B+ (investors, users, protocols)

Casualties:

- Retail investors: Life savings wiped out
- VCs: Jump Crypto, Three Arrows Capital (3AC later collapsed)
- DeFi protocols: Many held UST reserves, suffered losses

Bitcoin Reserve: Failed Rescue

Luna Foundation Guard (LFG):

- Reserve fund created to defend UST peg
- Raised $3B+ in Bitcoin, AVAX, other assets

Plan:

- If UST depegs, sell BTC to buy UST (support price)

Reality (May 2022):

- LFG deployed $1.5B BTC to buy UST
- Ineffective: Death spiral too fast
- Lost most of the BTC (sold near bottom)
- Remaining reserves (~$100M) insufficient

Lesson: Finite reserves cannot defend algorithmic peg under mass panic. Only collateralization works.

Three Arrows Capital (3AC) Contagion

Connection:

- 3AC was major LUNA investor
- Held billions in LUNA tokens

Cascade:

1. LUNA collapses (May 2022)
2. 3AC's collateral (LUNA) becomes worthless
3. 3AC fails to meet margin calls on other loans
4. Lenders (BlockFi, Celsius, Voyager) take massive losses
5. 3AC declares bankruptcy (July 2022)
6. CeFi contagion spreads: Celsius, Voyager, BlockFi all fail

Impact: Terra collapse triggered $200B+ broader crypto crash, multiple bankruptcies.

Lesson: Interconnected leverage amplifies failures. Terra was the first domino.

Do Kwon's Hubris

Quotes (Pre-Collapse):

- "I don't debate the poor." (Twitter, responding to critics)
- "95% of stablecoins will fail, UST will win."
- "Algorithmic stablecoins are the future of money."

Behavior:

- Dismissed warnings from economists, DeFi experts
- Aggressive marketing ("Lunatics" community)
- Promised unrealistic yields (20% Anchor)

Legal Aftermath:

- SEC charged Do Kwon with fraud (2023)
- Interpol arrest warrant issued
- Arrested in Montenegro (March 2023)
- Facing extradition to US or South Korea

Charges: Securities fraud, misleading investors, market manipulation.

Warning Signs (In Hindsight)

Red Flags That Were Ignored:

1. **Unsustainable Yield**
   - 20% APY with no underlying revenue
2. **Algorithmic Design Flaw**
   - No collateral backing, death spiral risk
3. **Concentration Risk**
   - $14B of $18B UST locked in Anchor (78%)
4. **Hubris and Dismissiveness**
   - Founder ignored criticism, attacked skeptics
5. **Rapid Growth**
   - UST grew from $2B to $18B in 6 months (too fast)
6. **Lack of Stress Testing**
   - No proven resilience during market downturns

Lessons Learned

For Investors:

- Beware of unsustainable yields (¿10% on stablecoins)
- Algorithmic stablecoins are experimental and risky
- Diversify across stablecoin types (don't go all-in on one)
- Hubris and dismissiveness are red flags

For Protocols:

- Overcollateralization is necessary for stability
- Stress test designs under extreme scenarios
- Don't rely on perpetual growth for sustainability
- Transparency and humility attract trust

For Regulators:

- Algorithmic stablecoins pose systemic risk
- Consider reserve requirements for stablecoins
- Protect retail investors from Ponzi-like yields

Survivor: DAI vs. UST

Why did DAI survive while UST collapsed?

UST (Failed)

- No collateral
- Pure algorithm
- Relied on LUNA value
- Death spiral possible
- Unsustainable yield (Anchor)

DAI (Survived)

- 150%+ overcollateralization
- Backed by ETH, USDC, etc.
- Independent of one token
- Liquidations prevent death spiral
- No unrealistic yield promises

Key Difference: Collateral provides demand floor. If DAI ¡ $1, arbitrageurs buy DAI to repay vaults profitably.

Conclusion: Overcollateralization is inefficient but necessary for stability.

Terra 2.0: Failed Reboot

Post-Collapse Plan (May 2022):

- Abandon UST (stablecoin)
- Relaunch Terra blockchain as "Terra 2.0"
- New LUNA token (non-algorithmic)
- Airdrop to UST/LUNA holders (compensation attempt)

Result:

- Terra 2.0 launched with minimal adoption
- New LUNA price: \$6 $\rightarrow$ \$0.50 (within months)
- Community fractured, trust destroyed
- Ecosystem projects migrated to other chains

Lesson: Trust, once broken, is nearly impossible to rebuild. Rebranding doesn't erase history.

Regulatory Fallout

US Response:

- SEC charged Do Kwon with fraud
- Hearings on stablecoin regulation
- Proposed legislation requiring reserve backing

Global Response:

- South Korea: Investigation into Terraform Labs
- Singapore: Tightened crypto regulations
- EU MiCA: Included stablecoin reserve requirements

Industry Impact:

- Algorithmic stablecoins largely abandoned
- FRAX increased collateral ratio to 100%
- Focus shifted to fiat-backed and overcollateralized models

Long-term: Terra collapse accelerated stablecoin regulation worldwide.

Psychological Factors

Why Did People Believe?

1. **Greed**
   - 20% APY too attractive to pass up
2. **FOMO**
   - Fear of missing out on "next big thing"
3. **Herd Mentality**
   - Everyone else was buying (social proof)
4. **Confirmation Bias**
   - Ignored critics, only listened to bulls
5. **Complexity**
   - Most users didn't understand the mechanism
6. **Charismatic Leader**
   - Do Kwon's confidence was persuasive

Lesson: Always question high yields. If it sounds too good to be true, it probably is.

Comparison: Terra vs. Traditional Bank Run

Traditional Bank Run

- Fractional reserves (10% capital)
- FDIC insurance ($250k/account)
- Central bank lender of last resort
- Slow (days to withdraw)
- Government can freeze

Terra Death Spiral

- Zero reserves (algorithmic)
- No insurance
- No lender of last resort
- Instant (blockchain speed)
- Unstoppable (permissionless)

Key Difference: Traditional finance has circuit breakers. DeFi operates 24/7 with no pause button.

Implication: DeFi failures can be faster and more catastrophic, but also more transparent.

Summary

Key Takeaways:

- Terra/Luna was $60B algorithmic stablecoin experiment that collapsed in May 2022
- UST-LUNA mechanism relied on arbitrage but had no collateral backing
- Anchor's 20% APY was unsustainable Ponzi-like scheme
- Death spiral: UST depeg → LUNA hyperinflation → total collapse
- $40B+ value destroyed, triggering broader crypto contagion (3AC, Celsius)
- Lessons: Beware unsustainable yields, algorithmic stablecoins need collateral
- Regulatory response: Accelerated stablecoin regulation globally

Next Lecture: Lab - Testnet Lending (hands-on with Aave, safe overcollateralized model).

Questions for Reflection

1. What structural difference between DAI and UST prevented DAI from collapsing?
2. Could the Bitcoin reserve have saved UST if it were larger (e.g., $20B)?
3. Why did Anchor's 20% APY attract deposits despite being unsustainable?
4. How could regulators have prevented Terra collapse without banning innovation?
5. Would you invest in a new algorithmic stablecoin if it had better design?