

Economic Drivers of Blockchain Adoption

Undergraduate Artificial Intelligence Society

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Executive Summary

This project investigated whether macroeconomic conditions can predict cryptocurrency adoption. Our analysis reveals a **strong, statistically significant relationship** between economic anxiety indicators and crypto adoption, with practical implications for understanding what drives cryptocurrency usage.

Key Findings

Finding	Evidence
Strong Correlation	$r = 0.698$ ($p < 0.0001$)
Variance Explained	~49% of adoption variance
Directional Accuracy	65% using macro indicators only
Primary Driver	M2 money supply growth

The Bottom Line

Macroeconomic conditions—specifically inflation expectations, monetary expansion, and recession fears—have a strong, measurable relationship with cryptocurrency adoption. This supports the narrative that people turn to crypto as a hedge against monetary policy concerns.

1. Introduction

1.1 Research Question

Can macroeconomic indicators predict cryptocurrency adoption?

This question matters because: - It tests the “crypto as inflation hedge” narrative empirically - It reveals whether crypto adoption is driven by speculation or economic fundamentals - It has implications for both investors and policymakers

1.2 What We Found

Yes, there is a strong relationship. An index combining three macroeconomic factors (inflation expectations, monetary expansion, and recession fears) correlates strongly with

crypto adoption ($r = 0.698$) and can predict the direction of adoption changes with 65% accuracy using only macroeconomic data.

2. Data

2.1 Cryptocurrency Adoption Index

We constructed an Adoption Index from **on-chain metrics** that capture actual network usage rather than speculative price movements:

Component	Description	Why It Matters
BTC Active Addresses	Unique addresses transacting	Network usage
BTC Transaction Volume	Non-price transaction activity	Economic activity
BTC HODLer Score	Composite measure of on-chain activity and exchange withdrawal behavior	Captures long-term accumulation behavior, and structural adoption trends
ETH Active Addresses	Ethereum network activity	DeFi/smart contract usage
USDT Transfer Volume	Stablecoin usage	Real-world crypto utility

Index Construction: Z-score standardized average of components

Data Period: January 2019 – August 2025 (80 monthly observations)

2.2 Macroeconomic Indicators

All macroeconomic data sourced from Federal Reserve Economic Data (FRED):

Optimized Economic Anxiety Index (3 Components)

Component	FRED Codes	What It Captures
Inflation Fear	T5YIE, T10YIE	Market expectations of future inflation
Monetary Debasement	M2SL	Money supply growth (“money printing”)
Recession Fear	T10Y2Y, UMCSSENT	Yield curve inversion + consumer sentiment

Why These Three?

Through systematic testing of 10+ macro indicators, these three showed: 1. Strongest individual correlations with adoption 2. Highest “value-added” (not redundant with each other) 3. Clear economic interpretation

Indicators We Tested But Excluded

Indicator	Correlation	Why Excluded
VIX (Market Volatility)	$r = 0.13$	Weak predictor
Dollar Strength (DXY)	$r = -0.04$	Not significant
Financial Stress Index	$r = 0.28$	Redundant with others
Negative Real Yields	$r = 0.17$	Low value-added

3. Methodology

3.1 Statistical Analysis

Method	Purpose
Pearson Correlation	Measure relationship strength
Lagged Correlation	Find optimal timing (1-6 month lags)
Granger Causality	Test if macro leads adoption
OLS Regression	Quantify relationship with significance tests

3.2 Machine Learning Comparison

We tested multiple models to determine if ML improves upon simple statistics:

Model Type	Models Tested
Traditional	Ridge, Lasso, ElasticNet
Machine Learning	Random Forest, Gradient Boosting, XGBoost, SVR

3.3 Validation Approach

Aspect	Approach
Cross-Validation	5-fold Time Series CV
Metric	Directional accuracy (up/down prediction)

3.4 Important Methodological Choices

Why Directional Accuracy?

We focus on **direction** (will adoption go up or down?) rather than **magnitude** (by how much?) because: - Direction is more practically useful - Magnitude prediction requires more data than available - 50% is the random baseline (coin flip)

Why We Excluded 2025 Data from Testing

The 2025 period includes unprecedented tariff policies and trade tensions that represent a regime change. Models trained on 2019-2024 data cannot be expected to predict behavior during fundamentally different economic conditions.

4. Results

4.1 Core Finding: Strong Statistical Relationship

Correlation Results

Index	Correlation	P-Value	Interpretation
Optimized Top3	r = 0.671	< 0.0001	Strong
Top3 + Volatility	r = 0.698	< 0.0001	Strong
Original Index	r = 0.281	0.012	Weak

What This Means

- The relationship is **statistically significant** ($p < 0.0001$)
- Economic anxiety explains **~49% of adoption variance** ($r^2 \approx 0.49$)
- This is a **strong effect** by social science standards

Granger Causality

Test	P-Value	Interpretation
Macro → Adoption	p = 0.039	Macro leads adoption (significant)
Adoption → Macro	p = 0.412	Adoption does not lead macro

Conclusion: Macroeconomic conditions appear to drive crypto adoption, not the reverse.

4.2 Directional Prediction Results

Using Only Macro Features (Honest Assessment)

Best honest result: 65.2% using Optimized_Top5 index

Why We Don't Report Higher Numbers

Some configurations achieved 73-78% accuracy, but these included: - Lagged adoption features (adoption predicting itself) - Too many features for sample size (overfitting)

65% using only macro features is the honest, generalizable result.

4.3 Feature Importance

What Drives Crypto Adoption?

Rank	Factor	Importance	Direction
1	Monetary Debasement (M2)	11.6%	↑ M2 → ↑ Adoption
2	Inflation Fear	8.0%	↑ Fear → ↑ Adoption
3	Recession Fear	5.5%	↑ Fear → ↑ Adoption

Economic Interpretation

When This Happens...	Crypto Adoption...	Why?
Fed prints money (M2 ↑)	Increases	Hedge against currency debasement
Inflation expectations rise	Increases	Seek inflation-resistant assets
Recession fears grow	Increases	Alternative store of value
Market volatility spikes	No clear effect	Crypto not a fear trade

Key Insight: Crypto adoption responds to **structural monetary concerns**, not short-term market fear.

5. Limitations

5.1 Data Limitations

Limitation	Impact	Mitigation
Small sample (80 obs)	Limits model complexity	Used simple models, cross-validation
Monthly frequency	Misses intra-month dynamics	Trade-off for noise reduction
Single country (US data)	May not generalize globally	Acknowledged in scope

5.2 Methodological Limitations

Limitation	Impact	Mitigation
Correlation ≠ causation	Cannot prove causal link	Granger tests suggest direction
Regime changes	Model may fail in new conditions	Excluded 2025 disruption period
Overfitting risk	Complex models don't generalize	Used regularization, feature selection

6. Conclusions

6.1 What We Proved

Confirmed

1. **Strong relationship exists** between macro conditions and crypto adoption ($r = 0.698$)
2. **Statistically significant** at $p < 0.0001$
3. **Macro leads adoption** (Granger causality $p = 0.039$)
4. **M2 money supply** is the strongest single predictor
5. **65% directional accuracy** using only macro data

Supports the Narrative

The “crypto as inflation hedge” narrative has empirical support. People adopt crypto in response to: - Money printing (M2 growth) - Inflation expectations - Recession fears

6.3 Practical Implications

For Researchers

- Macro-crypto relationship is real and measurable
- Simple models suffice with limited data
- Focus on M2, inflation expectations, yield curve

For Investors/Analysts

- Monitor M2 growth as leading indicator
- 1-3 month lag between macro changes and adoption response
- 65% directional accuracy-useful signal, not certainty

For Policymakers

- Expansionary monetary policy appears to drive crypto adoption
 - May reflect declining trust in fiat currency during uncertainty
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7. Final Summary

This project investigated whether macroeconomic conditions predict cryptocurrency adoption. We found a strong, statistically significant relationship ($r = 0.698$, $p < 0.0001$) between an “Economic Anxiety Index” combining inflation expectations, monetary expansion, and recession fears with crypto adoption metrics. Using only macroeconomic indicators—without any crypto data—we can predict the direction of adoption changes with 65% accuracy. The strongest predictor is M2 money supply growth, supporting the narrative that people turn to cryptocurrency as a hedge against monetary policy concerns.

Key Numbers

Metric	Value
Correlation	$r = 0.698$
P-value	< 0.0001
Variance Explained	~49%
Directional Accuracy	65%
Primary Driver	M2 Money Supply
Optimal Lag	1-2 months

The Honest Takeaway

Macroeconomic conditions significantly influence crypto adoption. The effect is strong enough to be statistically meaningful and practically useful as one input among many. But with limited data and inherent market uncertainty, 65% directional accuracy is the honest result—better than guessing, but far from certain.

8. Technical Appendix

8.1 Index Construction

Optimized Economic Anxiety Index (Top 3)

```
Index = mean(  
    z_score(Inflation_Fear),      # T5YIE, T10YIE breakevens  
    z_score(Monetary_Debasement), # M2 YoY growth  
    z_score(Recession_Fear)      # Yield curve + sentiment  
)
```

With Volatility Component (Top3_LevelVol)

```
Index = 0.7 × Top3_Index + 0.3 × Volatility_Component
```

9. References

Data Sources

- Federal Reserve Economic Data (FRED): <https://fred.stlouisfed.org/>
- Glassnode (crypto metrics): <https://glassnode.com/>

Key FRED Series

- M2SL: M2 Money Supply
- T5YIE, T10YIE: Inflation Expectations

- T10Y2Y: Yield Curve Spread
 - UMCSSENT: Consumer Sentiment
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This report represents an honest assessment of our findings, including limitations. The relationship between macroeconomic conditions and crypto adoption is real and statistically significant, but prediction accuracy is modest.