Senior Project

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Impact of COVID Stimulus Checks on Cryptocurrency Markets

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ABSTRACT

During the COVID-19 pandemic (2020–2022), the United States government disbursed Economic Impact Payments (EIPs) directly to citizens, breaking from more traditional, indirect stimulus methods. This paper investigates whether those EIPs influenced the cryptocurrency market from March 2020 to March 2021. While previous studies have focused primarily on Bitcoin, this research adopts a more "coin-agnostic" approach by examining market-wide data and comparing a "treatment" panel of cryptocurrencies that met stricter U.S. Know Your Customer (KYC) regulations to a "control" panel that did not and would have had minimal exposure to EIP investment.

A key motivation stems from the rapid expansion of cryptocurrency investors, who may adjust their strategies if evidence shows a correlation or causal link between government-issued payments and price behavior in digital assets. Policymakers are likewise interested in whether such direct payments to individuals fuel speculative investments at the expense of real economic growth. Because cryptocurrencies such as Bitcoin (BTC) have fixed supplies, large inflows of capital can amplify volatility and alter market dynamics.

Building on theoretical perspectives of "hard money" and inflation hedges, this paper aligns with studies by Divakaruni and Zimmerman (2021) and Di Maggio (2022), which suggest stimulus recipients can view cryptocurrency as a lottery-like opportunity or an inflation-resistant asset. Methodologically, the study employs a Two-Way Fixed Effects Difference-in-Differences (TWFE DiD) model, using market capitalization as the primary outcome variable. Data is collated from CoinGecko, CoinMarketCap, and TradingView to form a comprehensive panel of both widely listed and more obscure tokens.

Preliminary findings suggest that EIP-driven liquidity may have boosted market capitalizations, particularly for tokens accessible on U.S. exchanges. This effect underscores the ongoing tension between a "top heavy market" where BTC dominates, and "lottery ticket" market wherein investors gravitate toward high-volatility, smaller-cap tokens in hopes of disproportionate gains.

1

Table of Contents

1

I. INTRODUCTION

During the COVID-19 pandemic (2020–2022), policymakers in the United States enacted some of the most dramatic interventions in citizens' lives since the post-war period. Although most policies addressed health concerns, several targeted the economy. The most prominent example is the Economic Impact Payments (EIPs)—often called "stimulus checks"—which the government sent directly to individuals. This approach marks a significant shift from traditional American economic stimulus methods, which typically rely on banks, businesses, or tax cuts. Divakaruni and Zimmerman (2021) describe these payments as a "wealth shock" to recipient households. Multiple rounds of this shock occurred: the first stimulus checks were distributed in March 2020, and the third and final round concluded approximately one year later.

This paper analyzes whether the post-2020 cryptocurrency market is affected by these COVID-19 stimulus checks, focusing on the period during which the U.S. government actively distributed them. This research is highly relevant to cryptocurrency investors—a rapidly expanding cohort in the broader financial landscape—because a causal relationship between cryptocurrency markets and EIPs may offer valuable insights for future investment decisions under similar government interventions. If EIPs correlate with or even cause changes in cryptocurrency prices, investors might adjust their portfolios in anticipation of such measures. Policymakers may also be interested; for example, if a substantial portion of EIP funds flows into what many consider speculative cryptocurrencies, the stimulus effect on the real economy might be muted. Conversely, if market dynamics "reward" the speculation, it could encourage further speculative behavior fueled by future government payments. However, if speculators incur losses—due either to volatile markets or opportunistic scams—EIPs may inadvertently enrich large holders, exchanges, or other intermediaries, potentially diminishing the intended stimulus effect on the real economy.

Moreover, direct conversions of dollars into cryptocurrencies such as Bitcoin (BTC) may weaken the dollar relative to these alternative assets, paralleling traditional currency market dynamics. As cryptocurrency markets grow and absorb increasing capital, this effect becomes more significant. The rise in institutional-grade cryptocurrency exchange-traded funds (ETFs) underscores both the growth in market depth and the potential implications for investors and policymakers.

Although prior research explores the link between stimulus payments and Bitcoin, it has focused narrowly on BTC investment (Divakaruni & Zimmerman, 2021). In contrast, this paper broadens the scope beyond Bitcoin by relying on market- and coin-specific data to present a more "coin-agnostic" picture using a Differences in Differences approach. Using publicly available data from widely used cryptocurrency data aggregators, the analysis illustrates whether stimulus checks have influenced cryptocurrency markets more broadly. Early results have indicated that stimulus could have had an outsized effect on cryptocurrencies that were available to Americans during the stimulus period, however the quality of the control group panel data is a concern for establishing a causal link between EIPs and crypto growth. This was anticipated in the theoretical discussion of the research and thus far manifested in current results; a data cleansing or methodological remedy may be required and these will be elaborated on in those sections of the paper.

II. LITERATURE REVIEW

Government policy and cryptocurrency technology share a distinctive relationship compared to other financial innovations. In the wake of the 2008 financial crisis, policy decisions such as bank bailouts helped inspire the creation of the first digital currency secured by cryptography rather than by trust in a central authority (Divakaruni & Zimmerman, 2021). Although the foundational cryptographic concepts underpinning Bitcoin existed prior to its launch, Davidson and Rees-Mogg (1999) predicted in *The Sovereign Individual* that "cybermoney will turn out to be even more significant than government regulations in shaping the new century." This foresight foreshadows Bitcoin's emergence as a decentralized alternative to centrally issued currencies.

When Bitcoin's creator—known by the pseudonym "Satoshi Nakamoto"—released BTC in 2009, the embedded statement in the first "genesis" block criticized bank bailouts. This served as a direct protest against established monetary policy (Ammous, 2018). In the original Bitcoin Whitepaper, Nakamoto (2008) introduces a peer-to-peer electronic cash system that uses cryptographic proof-of-work to secure transactions—a system that contrasts sharply with the trust-based model of modern finance. Bitcoin's core features include (1) secure, trustless digital payments and (2) a strictly limited monetary policy determined by code rather than by a central issuer. The Bitcoin protocol halves the rate at which new bitcoin enters circulation every four years: in 2009, each new block generated 50 BTC (not 100 as some early variations suggest), a figure that dropped to 6.25 BTC by 2025, with a total supply eventually capping at 21 million. Nakamoto's innovation, described by Ammous (2018) in *The Bitcoin Standard* as "the first successful implementation of digital scarcity," is intended to deliver a monetary system largely immune to the influence of any political or financial authority.

While this paper considers the broader cryptocurrency market, Bitcoin remains its largest and most influential component. It has served as a template for subsequent projects that frequently embrace many of Bitcoin's core assumptions regarding monetary systems and the underlying legal frameworks. For instance, Ethereum (ETH) began as an attempt to add more complex transaction functions—such as smart contracts—to the Bitcoin network. After the Bitcoin community rejected the proposal, Ethereum forked into a standalone project. In the Ethereum Whitepaper, Buterin (2013) envisions a more flexible blockchain capable of hosting decentralized applications and advanced transaction types. Ethereum's more recent shift to a net-deflationary model in 2021 attests to its philosophical roots in Bitcoin's "hard money" ethos (Ammous, 2018). Thousands of other cryptocurrencies ("altcoins") have followed, with some offering meaningful innovations and others rebranding existing ideas. As Davidson and Rees-Mogg (1999) contend, digital money technologies create a fundamental technological asymmetry favoring freedom as opposed to the top-down control of money by the nation state that characterized most of the 20th century, and this ethos pervades the cryptocurrency ecosystem.

Money "hardness" underpins many analyses comparing cryptocurrencies to fiat currencies and their respective monetary policies. The COVID-19 stimulus checks serve as one example of a monetary policy event. In economic theory, inflation measures the decline in the real-world purchasing power of a currency when the money supply expands faster than productivity. This can be understood by comparing the existing "stock" of currency to the "flow" of new currency issuance. Although modern fiat systems often obscure this relationship, "hard money" (traditionally gold) remains a major selling point for Bitcoin, whose mathematically controlled supply yields a flow-to-stock ratio that eventually surpasses even gold's hardness (Ammous, 2018).

The literature on stimulus payments and cryptocurrencies primarily focuses on Bitcoin. Divakaruni and Zimmerman (2021) examine the effects of EIPs on Bitcoin, reporting that stimulus checks increased BTC trading volume by approximately 3.8% between April 9 and June 5, 2020. They also characterize the average EIP-funded crypto investor as a young, tech-savvy male without dependents who views cryptocurrency as a "lottery ticket" for high-yield gains. This so-called "lottery effect" could be even stronger for altcoins, which are typically smaller and more volatile, potentially offering proportionally higher returns.

Di Maggio (2025) analyzes investor behavior under COVID-19 stimulus measures, observing that retail investors often regard cryptocurrency as a hedge against rising inflation—a stance consistent with Bitcoin's original purpose as "sound money" (Ammous, 2018). Chowdhury, Abdullah, and Masih (2023) take a portfolio-based perspective and examine the risk–return dynamics of cryptocurrencies during the pandemic's inflationary period. Their findings suggest that digital assets sometimes fulfill their foundational promise of resilience against perceived monetary mismanagement, albeit with considerable volatility.

III. THEORY

Economists frequently study the effects of government spending on markets, particularly through the Keynesian perspective that emphasizes aggregate demand. However, the efficacy of stimulus checks as a crisis-response tool remains unclear because policymakers cannot ensure that recipients use these funds exclusively for goods and services. A portion of the funds may flow into speculative investments, including cryptocurrencies, rather than bolstering the real economy.

Direct payments like EIPs were unprecedented in the United States. Their emergence likely reflects a confluence of factors, including rising public interest in Universal Basic Income (UBI) and the extraordinary political and social conditions during the COVID-19 pandemic. Policymakers appeared more willing to break with convention by relaxing their historical aversion to direct federal payments. The analysis presented here may inform future discussions around UBI-like measures—especially in an environment where AI-driven productivity, cryptocurrency adoption, and institutional crypto-based financial products (e.g., ETFs) continue to expand.

This research measures the impact of EIPs distributed between March 2020 and March 2021 on cryptocurrency markets. Market capitalization (market cap) is the primary metric because it offers a "coin-agnostic" gauge of a cryptocurrency's value. Given the wide variation in token supplies, price alone is less informative. Like how equity investors use company valuations in traditional finance (TradFi), most retail traders rely on market cap rankings to judge a coin's relevance.

This study contrasts performance trends between cryptocurrencies listed on U.S. exchanges—where strict Know Your Customer (KYC) rules apply—and those that remain offshore. In practice, opening a U.S. exchange account generally requires a driver's-license or passport scan plus live-photo verification, hurdles that even many law-abiding traders dislike. Exchanges, meanwhile, will not jeopardize compliance by listing tokens that might violate securities laws or invite market-manipulation claims. Binance, for instance, offers thousands of coins on its global platform yet withholds many of them from Binance.US for exactly these reasons; Coinbase follows comparable KYC protocols and additionally screens candidates by market cap, liquidity, and reputational "optics." Accordingly, the **treatment group** in this analysis consists of cryptocurrencies readily accessible to U.S. stimulus-check recipients, whereas the **control group** contains tokens absent from major U.S. venues.

A differences-in-differences approach is expected to confirm prior Bitcoin-focused findings—that EIPs boost trading volumes and market caps, particularly in the treatment group. Because selling orders in cryptocurrency markets often arise from leveraged liquidations rather than deliberate selling, market cap may more accurately capture the cumulative effect of cash inflows.

A key question is whether large, well-known coins—already available on U.S. exchanges—benefit more from the stimulus than smaller, less accessible tokens. Name recognition and reputational advantages could concentrate stimulus-funded buying in top-tier coins. Conversely, the "lottery effect" (Divakaruni & Zimmerman, 2021) may drive new retail investors toward smaller altcoins in pursuit of higher potential returns. This tension mirrors debates in the stock market between "blue-chip" stocks and "penny stocks."

To summarize, cryptocurrency markets differ markedly from traditional markets due to continuous global trading, variable regulation, and widely varying liquidity conditions. The stimulus checks distributed in early to mid-2020 constituted a sudden liquidity injection for U.S. retail investors. Standard economic theory suggests that if recipients direct a portion of these funds to cryptocurrency purchases, an upward shift in crypto demand—and consequently market cap—should be observable. Alternatively, if EIP recipients allocate funds toward consumption or traditional investments, the crypto-specific effect may be smaller. Overall, the expectation is that an exogenous liquidity shock, such as stimulus checks, induces a positive price and trading-volume response in the cryptocurrency market, especially for assets that are readily accessible to U.S. investors.

IV. DATA

Cryptocurrency markets pose unique measurement challenges because they operate worldwide on a 24/7 basis, unlike the fixed trading hours of traditional asset markets. In traditional finance, firms evolve under established regulations and corporate strategies—with splits, mergers, and acquisitions communicated through well-known channels. By contrast, in the cryptocurrency ecosystem the asset itself is the innovation layer, leading to unusual market dynamics and data complexities. Despite these obstacles, an industry of aggregators has emerged to record and publish crypto data, enabling the current analysis.

No single data source provides a perfectly clean dataset. Therefore, constructing the sample requires extensive cross-referencing among three primary aggregators. CoinGecko provides primary data on market capitalization, price, and volume. CoinMarketCap's "Market Snapshot" tool identifies potential tokens for the dataset and verifies that CoinGecko's figures are reasonable, as well as confirming a cryptocurrency's trading "activity" status. TradingView offers information on where tokens trade—including on which exchanges and in which base pairs—during the treatment period.

Market capitalization is the primary outcome variable. Although not flawless, market cap offers a straightforward indication of each token's value and is widely used by retail traders to gauge a coin's relevance. While price is also an important variable, it can be misleading for cross-coin comparisons due to the wide variation in token supplies. Volume data primarily serves as supplementary information to confirm the legitimacy and activity of certain coins, especially smaller ones that might lack fully verified supply metrics.

This multi-source strategy helps to distinguish between coins that qualify for the treatment group and those that do not. In some cases, an aggregator may provide token price data without a verified supply figure to calculate a reliable market cap. Such tokens often trade in decentralized liquidity pools or other obscure markets, which limits transparency regarding total supply or inflation/deflation rates. As a result, market cap measurements for these tokens are unreliable and they are excluded from the primary panel. Summary stats are in table 4.1. Parallel Trend Test and Visual Representations comprise figures 4.2-4.4

4.1

Summary Statistics: Market Cap by Treatment Group (in millions USD)

The MEANS Procedure

Analysis Variable : market_cap_mil Market Cap (millions USD)							
treatment	N Obs	N	Mean	Median	Std Dev	Minimum	Maximum
0	4554	4554	0.000213671	0.000033586	0.000649800	1.6195478E-8	0.0118014
1	1794	1794	0.0199143	0.000846731	0.0952599	0.000010940	1.1541093

Summary Statistics: Volume by Treatment Group (in thousands)

The MEANS Procedure

Analysis Variable : volume_thou Volume (thousands)							
treatment	N Obs	N	Mean	Median	Std Dev	Minimum	Maximum
0	4554	4554	34.1398383	2.0468782	205.9311493	5.5062541E-7	5806.39
1	1794	1794	3013.08	166.6599186	10377.13	0.0096770	114169.48

Summary Statistics: Price by Treatment Group (USD)

The MEANS Procedure

Analysis Variable : price Price (USD)							
treatment	N Obs	N	Mean	Median	Std Dev	Minimum	Maximum
0	4554	4554	5.1783834	0.1256454	26.0002287	1.6963493E-6	424.2847438
1	1794	1794	700.7892163	1.2403869	4735.43	0.0012156	61279.42

*Note: On a nominal basis, treatment and control statistics differ widely by orders of magnitude, and the control group has some extreme outliers to the downside, but in aggregate they are more proportional than summary statistics reflect, as you will see with a log adjustment.

4.2

Pre-Treatment Trends: Log Avg Market Cap by Group

The SURVEYREG Procedure

Regression Analysis for Dependent Variable log_mcap

Data Summary	
Number of Observations	1932
Mean of log_mcap	4.19511
Sum of log_mcap	8105.0

Design Summary	
Number of Clusters	138

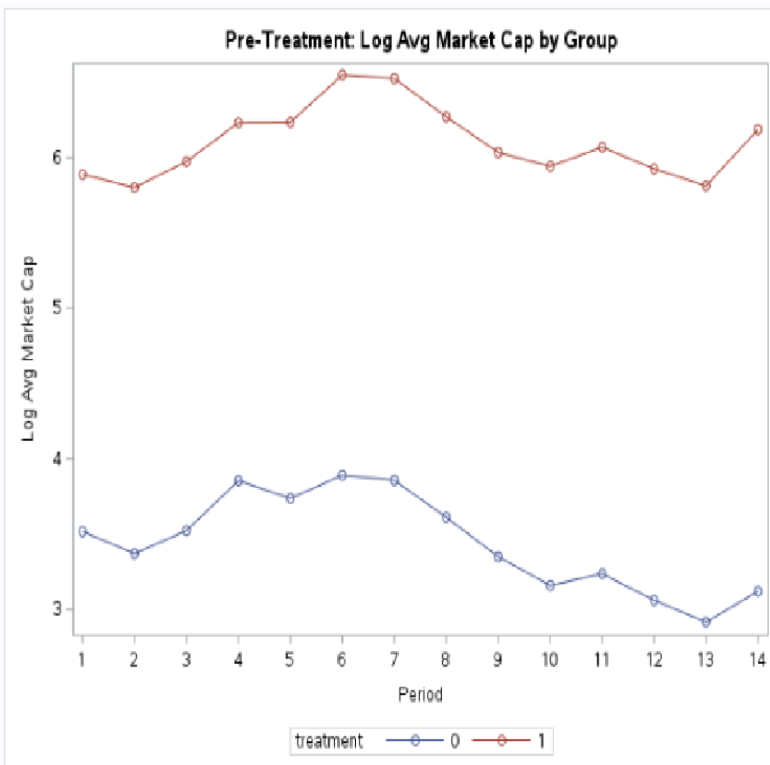
Fit Statistics	
R-Square	0.4178
Root MSE	1.4496
Denominator DF	137

Tests of Model Effects			
Effect	Num DF	F Value	Pr > F
Model	7	74.97	<.0001
Intercept	1	801.57	<.0001
period	1	162.94	<.0001
period2	1	159.69	<.0001
period3	1	111.01	<.0001
treatment	1	53.32	<.0001
DID	1	0.64	0.4255
DID2	1	0.00	0.9695
DID3	1	0.04	0.8407

Note: The denominator degrees of freedom for the F tests is 137.

Estimated Regression Coefficients				
Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	2.9566808	0.10443186	28.31	<.0001
period	0.4127154	0.03233253	12.76	<.0001
period2	-0.0595417	0.00471174	-12.64	<.0001
period3	0.0021685	0.00020581	10.54	<.0001
treatment	2.3243710	0.31831701	7.30	<.0001
DID	0.0407633	0.05099842	0.80	0.4255
DID2	-0.0002976	0.00776080	-0.04	0.9695
DID3	0.0000674	0.00033454	0.20	0.8407

Note: The degrees of freedom for the t tests is 137.



4.3

Pre-Treatment Trends: Log Avg Volume by Group

The SURVEYREG Procedure

Regression Analysis for Dependent Variable log_vol

Data Summary	
Number of Observations	1932
Mean of log_vol	8.33004
Sum of log_vol	16093.6

Design Summary	
Number of Clusters	138

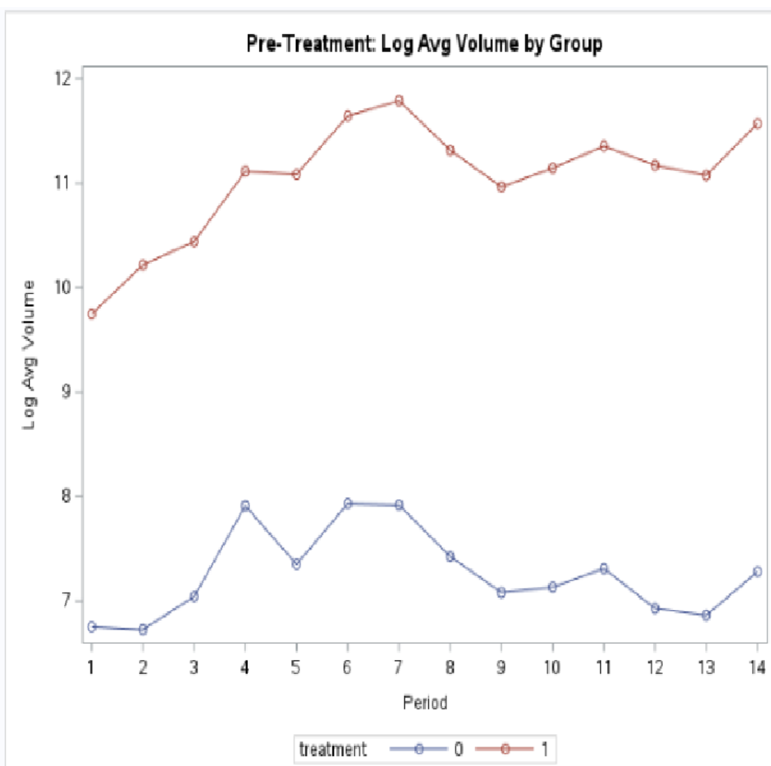
Fit Statistics	
R-Square	0.3311
Root MSE	2.4862
Denominator DF	137

Tests of Model Effects			
Effect	Num DF	F Value	Pr > F
Model	7	43.96	<.0001
Intercept	1	690.73	<.0001
period	1	103.74	<.0001
period2	1	75.01	<.0001
period3	1	53.67	<.0001
treatment	1	38.44	<.0001
DID	1	2.35	0.1272
DID2	1	0.34	0.5604
DID3	1	0.17	0.6847

Note: The denominator degrees of freedom for the F tests is 137.

Estimated Regression Coefficients				
Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	5.7699060	0.21954109	26.28	<.0001
period	0.8154657	0.08006215	10.19	<.0001
period2	-0.1071787	0.01237525	-8.66	<.0001
period3	0.0039941	0.00054522	7.33	<.0001
treatment	2.9390834	0.47406530	6.20	<.0001
DID	0.1743821	0.11363532	1.53	0.1272
DID2	-0.0094442	0.01618195	-0.58	0.5604
DID3	0.0002808	0.00069008	0.41	0.6847

Note: The degrees of freedom for the t tests is 137.



4.4

Pre-Treatment Trends: Log Avg Price by Group

The SURVEYREG Procedure

Regression Analysis for Dependent Variable log_prc

Data Summary	
Number of Observations	1932
Mean of log_prc	-1.53355
Sum of log_prc	-2962.8

Design Summary	
Number of Clusters	138

Fit Statistics	
R-Square	0.1202
Root MSE	2.8732
Denominator DF	137

Tests of Model Effects

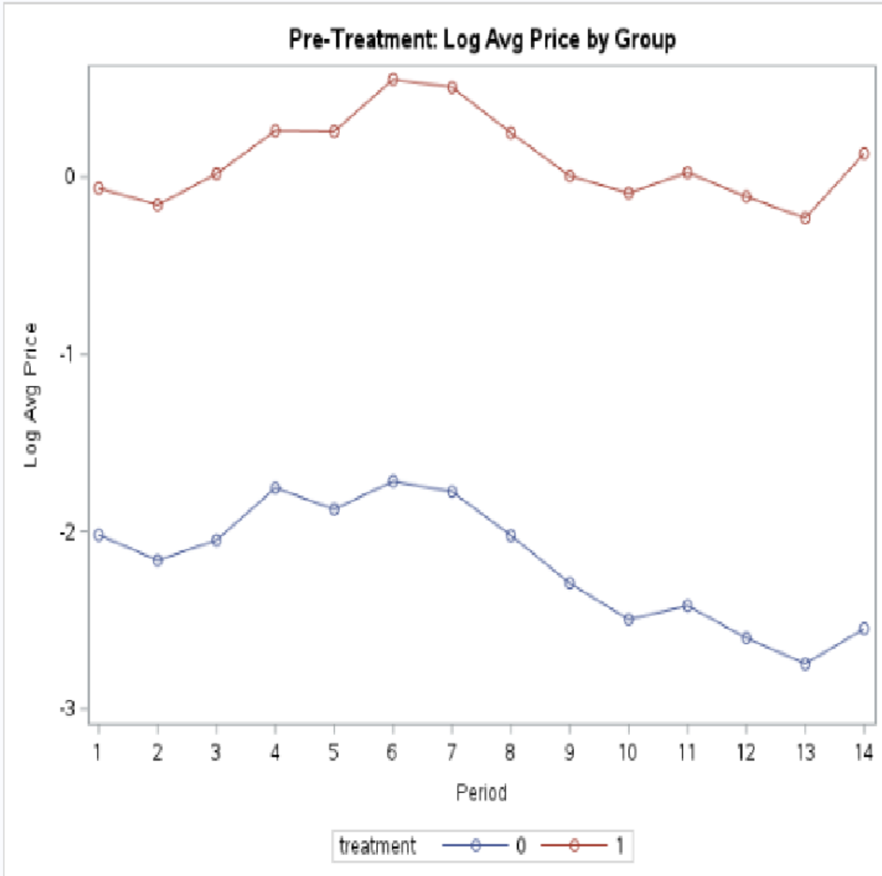
Effect	Num DF	F Value	Pr > F
Model	7	75.79	<.0001
Intercept	1	104.16	<.0001
period	1	191.87	<.0001
period2	1	199.47	<.0001
period3	1	143.62	<.0001
treatment	1	10.71	0.0013
DID	1	2.21	0.1397
DID2	1	0.30	0.5848
DID3	1	0.46	0.5002

Note: The denominator degrees of freedom for the F tests is 137.

Estimated Regression Coefficients

Parameter	Estimate	Standard Error	t Value	Pr > |t|
Intercept	-2.5389791	0.24877022	-10.21	<.0001
period	0.3806468	0.02748014	13.85	<.0001
period2	-0.0572187	0.00405138	-14.12	<.0001
period3	0.0021038	0.00017555	11.98	<.0001
treatment	1.8773062	0.57352134	3.27	0.0013
DID	0.0681251	0.04586253	1.49	0.1397
DID2	-0.0037595	0.00686519	-0.55	0.5848
DID3	0.0001991	0.00029451	0.68	0.5002

Note: The degrees of freedom for the t tests is 137.



*Note: As you can see visually and also from the p-values, while the Treatment and Control group start out at significantly different levels, by observing the DID variables across a log-adjusted polynomial Parallel Trend Test, the two groups are representational of each other for the pre-treatment period, indicating that they are suitable to be used in my TWFE DID model.

V. METHODOLOGY

A Two-Way Fixed Effects (TWFE) Difference-in-Differences (DiD) model quantifies the impact of EIPs on cryptocurrency market capitalization. The model is specified as follows:

$$Y_{pc} = B_0 + B_1 Stimulus\ x\ Availability_{pc} + Crypto_c + Period_p + \varepsilon_{pc} \quad (1)$$

$$logY_{pc} = B_0 + B_1 Stimulus\ x\ Availability_{pc} + Crypto_c + Period_p + \varepsilon_{pc} \quad (2)$$

Two primary models were used under the Two-Way Fixed Effects (TWFE) Differences-in-Differences (DiD) methodology. Model 1 is a standard regression and Model 2 performs a simple log-linear transformation on the outcome variable, otherwise the variables used are unchanged. *Y* is the Market Capitalization (token price multiplied by circulating supply) measured in millions of dollars respective to the specific crypto, *c*, and period, *p*. B_0 is the intercept of the regression, essential for modeling but otherwise not relevant for analysis. *B1* is the main coefficient of interest measuring the effect of the DiD term, *Stimulus x Availability*, for treatment data constructed from analysis of the individual crypto, *c'*s ability to be purchased on a widely available US exchange within the correct interval of period, *p*. To be clear, this establishes the DiD variable based on two criteria with binary values; *Availability* = 1 if the coin was available for purchase on a US-based exchange and 0 otherwise. *Stimulus* is zero by default and becomes equal to 1 after the initial round of Stimulus checks. *Crypto* represents coin fixed effects. *Period* represents time fixed effects. ε_{pc} is the white noise. A caveat worth noting is that there are currently no other control variables. This choice was made due to the highly idiosyncratic nature of the diverse technologies, marketing, and cultural/regional factors that vary widely among the panel tokens and in my opinion need to remain confined to coin fixed effects for efficiency at the scope of this analysis.

One caveat merits closer attention: the treatment-group panel carries a markedly higher average market-capitalization than the control panel across the entire sample. A "fairer" comparison might drop additional control-group tokens with very low capitalization or thin trading volume, yet I have resisted that step here to avoid accusations of arbitrary exclusion or cherry-picking. The roster instead reflects the coins that survived an initial cleaning of the 200 largest tokens (by market cap at the start of the pre-treatment window). Notably, an earlier panel—drawn from the top 100 coins nearer to the treatment date—produced stronger pre-treatment similarity, hinting that tighter trimming could improve balance.

Because crypto is still an innovation frontier, tokens below a certain name-recognition threshold often post sharper price growth than veterans that have already cycled through one boom-and-bust. Consequently, a wider, more mature control panel may mechanically underperform, exaggerating treatment effects. Another confounding factor is "wash trading," a practice in which market actors buy and sell the same asset repeatedly to inflate apparent activity. Wash trades are notoriously hard to verify without granular, exchange-level data—well beyond this study's scope—and they are far likelier in the less-regulated control group than in the U.S.-listed treatment group. Crucially, wash trading primarily distorts volume, not price; and because it is coin-specific, the coin fixed effects in the TWFE framework should absorb much of its influence.

VI. RESULTS

Variables	Market Cap	Log Market Cap
Period	7.03***	0.01**
	(1.75)	(0.01)
Stimulus	930.88*	0.04***
	(520.36)	(0.01)
Intercept	-21,615.64*	4.50***
	(12,228.36)	(0.15)
Coin Fixed Effects	Yes	Yes
No. Obs	6,348	6,348
Adj. R-Square	0.6087092545	0.8530418829
Overall Significance	55.18	318.47

Sources: Coingecko(data) CoinMarketCap(panel) Tradingview(treatment)
Notes: robust standard errors in parentheses, clustered by coin. Dependent Variable in column header.

Variables	Volume	Log Volume
Period	-20.11	-0.01
	(463.10)	(0.01)
Stimulus	57,718.44*	0.05***
	(30,611.10)	(0.01)
Intercept	-1,265,352.20*	9.89***
	(719,278.52)	(0.16)
Coin Fixed Effects	Yes	Yes
No. Obs	6,348	6,348
Adj. R-Square	114.05	228.75

Sources: CoinGecko(data) CoinMarketCap(panel) TradingView(treatment)
Notes: Robust standard errors in parentheses, clustered by coin. Dependent Variable in column header

Variables	Price	Log Price
Period	0.13*	0.00
	(0.06)	(0.00)
Stimulus	28.36	0.04***
	(24.73)	(0.01)
Intercept	-668.81	-1.82***
	(581.16)	(0.13)
Coin Fixed Effects	Yes	Yes
No. Obs	6,348	6,348
Adj. R-Square	59.33	743.32

Sources: CoinGecko(data) CoinMarketCap(panel) TradingView(treatment)
Notes: Robust standard errors in parentheses, clustered by coin. Dependent Variable in column header

Preliminary results from the differences-in-differences analysis indicate that EIPs are associated with an increase in market capitalizations, particularly within the treatment group, for both standard regression and log adjusted with a coefficient of 930.88 (million) at a confidence level of 99% for the linear clustered model and 0.04 at 99% for the log clustered model. Price had coefficient of 28.36 for linear and 4% for the log model, mirroring Market Cap as we should expect with Market Cap being mostly a function of Price. Volume had the largest treatment effect when log adjusted at 5%, with a linear coefficient of 57,718 (thousands), and this makes a lot of sense when the treatment group includes Bitcoin and Ethereum, coins that were already beginning to see exposure to more traditional market involvement in addition to stimulus liquidity. A key area of inquiry was whether large, well-known coins, already available on U.S. exchanges, benefit more from the stimulus than smaller, less accessible tokens. These results tentatively confirm this prior speculation. Name recognition and reputational advantages seem to concentrate stimulus-funded buying in top-tier coins and dominated the higher “lottery effect” of smaller coins, at least for the treatment period analyzed.

I think these results are very significant (even in the non-statistical sense). In my opinion many Americans are myopic in our perception of US influence on markets, especially one as international as cryptocurrency. The results showing that US Stimulus Checks were able to create a 4-5% movement in key crypto market statistics is a very powerful indicator as to the power that fiscal stimulus could have on any asset category, especially considering that crypto enthusiasts are a minority compared to real estate and stock investors (where potential further analysis could be done for a non-crypto focused researcher).

Data for this analysis are drawn from CoinGecko, CoinMarketCap, and TradingView, allowing for comparisons of market capitalization changes within and between treatment and control groups before, during, and after the stimulus period.

VI. CONCLUSION

This paper investigates whether the unprecedented COVID-19 Economic Impact Payments (EIPs) are associated with shifts in cryptocurrency market capitalization and trading volume, emphasizing how both large “blue-chip” cryptocurrencies and smaller “altcoins” responded to the stimulus. The evidence indicates a meaningful correlation: a portion of government-issued funds appears to have flowed into digital-asset markets, with the clearest impact on coins easily accessed through U.S. exchanges—namely Bitcoin, Ethereum, and a select set of high-profile altcoins. This finding aligns with the “wealth shock” view of direct payments and suggests that, contrary to the classic "lottery-effect" expectation that riskier coins would see the biggest boost, much of the stimulus-driven liquidity concentrated in major, more established tokens. Reputation, liquidity advantages, and U.S. regulatory barriers that limit access to many speculative altcoins likely steered recipients toward these better-known assets.

Those dynamics carry important policy implications. If EIPs were designed primarily to support household consumption of goods and services, substantial inflows into speculative assets can dilute—or redirect—the stimulus's intended real-economy impact. Policymakers and regulators may therefore view such spillovers with caution, especially when they heighten market volatility or accentuate wealth inequality. On the other hand, stronger price support and deeper liquidity in well-established cryptocurrencies can attract additional institutional capital, further embedding digital assets within traditional finance. As crypto-linked exchange-traded funds and other institutional-grade products proliferate, officials and central bankers will need to reassess how public funds circulate and how tightly these new asset classes intertwine with the broader financial system.

Several limitations suggest avenues for future research. First, although a Two-Way Fixed Effects (TWFE) Difference-in-Differences framework helps control for unobserved heterogeneity across time and tokens, capturing coin-specific nuances remains challenging. Expanding the model to include macroeconomic controls or crypto-specific variables—such as mining difficulty—could refine the estimates, provided researchers avoid "bad controls" that introduce bias. Second, the crypto market's pronounced cyclicality complicates causal inference. Bitcoin's four-year "halving" events—when the new-coin supply is cut in half—have historically driven bullish cycles and subsequent rotations into higher-beta altcoins. Explicitly modeling these cycles would strengthen future analyses. Third, more granular data on investor demographics and psychographics could clarify why certain cohorts gravitate toward smaller, riskier tokens despite greater volatility. Finally, excluding large-cap coins like BTC and ETH from the primary panel would directly test whether lower-cap tokens indeed exhibit a stronger lottery effect when government liquidity enters the market.

In summary, the surge of direct stimulus payments during the COVID-19 pandemic offers a rare natural experiment for observing how macro-level interventions intersect with an emerging—and highly speculative—financial frontier. While EIPs appear to have boosted market capitalization and trading volume in U.S.-accessible cryptocurrencies in the short run, long-term outcomes will depend on the evolving interplay among technological innovation, regulatory policy, and investor sentiment. As digital assets gain further traction, future stimulus measures could again reverberate through crypto markets, underscoring the need for cohesive regulatory frameworks, responsible investment strategies, and deeper scholarly inquiry into this rapidly evolving sector.

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APPENDIX

note: code was separated between programs for clarity/troubleshooting

SUMMARY STATS SCRIPT:

```
OPTIONS NONOTES NOSOURCE NOSYNTAXCHECK;



/* --- 1. Import Data from Excel --- */

PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

   out=work.cap_data dbms=xlsx replace;

   sheet="AdjustedMarketCap";  getnames=yes;

RUN;



PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

   out=work.vol_data dbms=xlsx replace;

   sheet="AdjustedVolume";     getnames=yes;

RUN;



PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

   out=work.prc_data dbms=xlsx replace;
```

```
   sheet="PriceVert";         getnames=yes;
RUN;


PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"
   out=work.trt_data dbms=xlsx replace;
   sheet="Treatment";         getnames=yes;
RUN;


/* --- 2. Transpose treatment flags once --- */
proc transpose data=work.trt_data
           out=work.trt_long(rename=(_NAME_=crypto col1=treatment));
  var ADA AE AGI AION AOA ARDR ARK BAT BCH BCN BFT BIX BNB BNT BRD
        BSV BTC
    BTG BTM BTS CMT CND CS CVC DASH DCN DCR DENT DGB DGTX DOGE
        DRGN EDG ELA
    ELF EMC ENG ENJ EOS ETC ETH ETN ETP EURS FCT FUN GAS GNO GNT GO
        GRS GTO GUSD
    GVT GXC HC HT ICX IGNIS KCS KMD KNC LINK LOOM LRC LSK LTC MANA
        MFT MIOTA MITH
```

```
    MKR NANO NAS NEBL NEO NEXO NULS NXS NXT ODEM ODN OMG ONT
        PART PAX PAY PIVX PLR
    POLY PPC PPT PUM QASH QNT QTUM RDD REP REQ RLC RVN SALT SC
        SMART SNT STEEM
    STORJ STRAT SUB SYS TCT TEL TEN THETA TOMO TRX TUSD USDC USDT
        VET VTC WAN
    WAVES WAXP WGR WICC WTC XEM XLM XMR XRP XTZ XVG XZC ZEC ZEN
        ZIL ZRX;
run;
proc sort data=work.trt_long; by crypto; run;


/* --- 3A. Summary: Market Cap (in millions) by Treatment Group --- */
/* 3A.1 reshape wide→long */
data cap_wide;
  set work.cap_data;
  rename Ticker = date;
run;
proc transpose data=cap_wide out=cap_long(drop=_LABEL_);
  by date;
```

```
  var ADA AE AGI AION AOA ARDR ARK BAT BCH BCN BFT BIX BNB BNT BRD
        BSV BTC
    BTG BTM BTS CMT CND CS CVC DASH DCN DCR DENT DGB DGTX DOGE
        DRGN EDG ELA
    ELF EMC ENG ENJ EOS ETC ETH ETN ETP EURS FCT FUN GAS GNO GNT GO
        GRS GTO GUSD
    GVT GXC HC HT ICX IGNIS KCS KMD KNC LINK LOOM LRC LSK LTC MANA
        MFT MIOTA MITH
    MKR NANO NAS NEBL NEO NEXO NULS NXS NXT ODEM ODN OMG ONT
        PART PAX PAY PIVX PLR
    POLY PPC PPT PUM QASH QNT QTUM RDD REP REQ RLC RVN SALT SC
        SMART SNT STEEM
    STORJ STRAT SUB SYS TCT TEL TEN THETA TOMO TRX TUSD USDC USDT
        VET VTC WAN
    WAVES WAXP WGR WICC WTC XEM XLM XMR XRP XTZ XVG XZC ZEC ZEN
        ZIL ZRX;
run;


data cap_long2;
  set cap_long;
```

```
  crypto          = _NAME_;
  market_cap      = COL1;
  market_cap_mil  = market_cap / 1e6;
  label market_cap_mil = "Market Cap (millions USD)";
  keep crypto market_cap_mil;
run;

proc sort data=cap_long2; by crypto; run;

data cap_merged;
  merge cap_long2 (in=a) work.trt_long (in=b);
  by crypto;
  if a;
run;

proc means data=cap_merged n mean median std min max;
  class treatment;
  var market_cap_mil;
```

```
  title "Summary Statistics: Market Cap by Treatment Group (in millions USD)";
run;

/* --- 3B. Summary: Volume (in thousands) by Treatment Group --- */
/* 3B.1 reshape wide→long */
data vol_wide;
  set work.vol_data;
  rename Ticker = date;
run;
proc transpose data=vol_wide out=vol_long(drop=_LABEL_);
  by date;
  var ADA AE AGI AION AOA ARDR ARK BAT BCH BCN BFT BIX BNB BNT BRD
        BSV BTC
    BTG BTM BTS CMT CND CS CVC DASH DCN DCR DENT DGB DGTX DOGE
        DRGN EDG ELA
    ELF EMC ENG ENJ EOS ETC ETH ETN ETP EURS FCT FUN GAS GNO GNT GO
        GRS GTO GUSD
```

```
    GVT GXC HC HT ICX IGNIS KCS KMD KNC LINK LOOM LRC LSK LTC MANA
        MFT MIOTA MITH
    MKR NANO NAS NEBL NEO NEXO NULS NXS NXT ODEM ODN OMG ONT
        PART PAX PAY PIVX PLR
    POLY PPC PPT PUM QASH QNT QTUM RDD REP REQ RLC RVN SALT SC
        SMART SNT STEEM
    STORJ STRAT SUB SYS TCT TEL TEN THETA TOMO TRX TUSD USDC USDT
        VET VTC WAN
    WAVES WAXP WGR WICC WTC XEM XLM XMR XRP XTZ XVG XZC ZEC ZEN
        ZIL ZRX;
run;


data vol_long2;
  set vol_long;
  crypto        = _NAME_;
  volume        = COL1;
  volume_thou   = volume / 1e3;
  label volume_thou = "Volume (thousands)";
  keep crypto volume_thou;
```

```
run;

proc sort data=vol_long2; by crypto; run;

data vol_merged;
  merge vol_long2 (in=a) work.trt_long (in=b);
  by crypto;
  if a;
run;

proc means data=vol_merged n mean median std min max;
  class treatment;
  var volume_thou;
  title "Summary Statistics: Volume by Treatment Group (in thousands)";
run;

/* --- 3C. Summary: Price by Treatment Group --- */
```

```
/* 3C.1 reshape wide→long */

data prc_wide;

  set work.prc_data;

  rename Ticker = date;

run;

proc transpose data=prc_wide out=prc_long(drop=_LABEL_);

  by date;

  var ADA AE AGI AION AOA ARDR ARK BAT BCH BCN BFT BIX BNB BNT BRD
        BSV BTC

    BTG BTM BTS CMT CND CS CVC DASH DCN DCR DENT DGB DGTX DOGE
        DRGN EDG ELA

    ELF EMC ENG ENJ EOS ETC ETH ETN ETP EURS FCT FUN GAS GNO GNT GO
        GRS GTO GUSD

    GVT GXC HC HT ICX IGNIS KCS KMD KNC LINK LOOM LRC LSK LTC MANA
        MFT MIOTA MITH

    MKR NANO NAS NEBL NEO NEXO NULS NXS NXT ODEM ODN OMG ONT
        PART PAX PAY PIVX PLR

    POLY PPC PPT PUM QASH QNT QTUM RDD REP REQ RLC RVN SALT SC
        SMART SNT STEEM
```

```
    STORJ STRAT SUB SYS TCT TEL TEN THETA TOMO TRX TUSD USDC USDT
        VET VTC WAN
    WAVES WAXP WGR WICC WTC XEM XLM XMR XRP XTZ XVG XZC ZEC ZEN
        ZIL ZRX;
run;


data prc_long2;
  set prc_long;
  crypto = _NAME_;
  price  = COL1;
  label price = "Price (USD)";
  keep crypto price;
run;


proc sort data=prc_long2; by crypto; run;


data prc_merged;
  merge prc_long2 (in=a) work.trt_long (in=b);
  by crypto;
```

```
  if a;
run;

proc means data=prc_merged n mean median std min max;
  class treatment;
  var price;
  title "Summary Statistics: Price by Treatment Group (USD)";
run;
```

PARALLEL TRENDS TEST SCRIPT:

```
OPTIONS NONOTES NOSOURCE NOSYNTAXCHECK;

/* --- 1. Import Data from Excel --- */
PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"
    out=work.cap_data dbms=xlsx replace;
    sheet="AdjustedMarketCap";  getnames=yes;
RUN;
```

```
PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

   out=work.vol_data dbms=xlsx replace;

   sheet="AdjustedVolume";     getnames=yes;

RUN;


PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

   out=work.prc_data dbms=xlsx replace;

   sheet="PriceVert";          getnames=yes;

RUN;


PROC IMPORT datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

   out=work.trt_data dbms=xlsx replace;

   sheet="Treatment";          getnames=yes;

RUN;


/* --- 2. Transpose treatment flags once --- */

proc transpose data=work.trt_data

            out=work.trt_long(rename=(_NAME_=crypto col1=treatment));
```

```
var ADA AE AGI AION AOA ARDR ARK BAT BCH BCN BFT BIX BNB BNT BRD
    BSV BTC
  BTG BTM BTS CMT CND CS CVC DASH DCN DCR DENT DGB DGTX DOGE
    DRGN EDG ELA
  ELF EMC ENG ENJ EOS ETC ETH ETN ETP EURS FCT FUN GAS GNO GNT GO
    GRS GTO GUSD
  GVT GXC HC HT ICX IGNIS KCS KMD KNC LINK LOOM LRC LSK LTC MANA
    MFT MIOTA MITH
  MKR NANO NAS NEBL NEO NEXO NULS NXS NXT ODEM ODN OMG ONT
    PART PAX PAY PIVX PLR
  POLY PPC PPT PUM QASH QNT QTUM RDD REP REQ RLC RVN SALT SC
    SMART SNT STEEM
  STORJ STRAT SUB SYS TCT TEL TEN THETA TOMO TRX TUSD USDC USDT
    VET VTC WAN
  WAVES WAXP WGR WICC WTC XEM XLM XMR XRP XTZ XVG XZC ZEC ZEN
    ZIL ZRX;
run;
proc sort data=work.trt_long; by crypto; run;


/* --- 3. Macro to reshape, test, and plot for any metric --- */
```

```
%macro pretrend(data=, out=, metric=, logm=, title=);

 /* A. Reshape wide→long */
 data work.&out._wide;
   set work.&data;
   rename Ticker = date;
 run;
 proc sort data=work.&out._wide; by date; run;

 proc transpose data=work.&out._wide
               out=work.&out._long;
   by date;
   var ADA AE AGI AION AOA ARDR ARK BAT BCH BCN BFT BIX BNB BNT BRD
       BSV BTC
     BTG BTM BTS CMT CND CS CVC DASH DCN DCR DENT DGB DGTX DOGE
       DRGN EDG ELA
     ELF EMC ENG ENJ EOS ETC ETH ETN ETP EURS FCT FUN GAS GNO GNT
       GO GRS GTO GUSD
```

```
    GVT GXC HC HT ICX IGNIS KCS KMD KNC LINK LOOM LRC LSK LTC
      MANA MFT MIOTA MITH
    MKR NANO NAS NEBL NEO NEXO NULS NXS NXT ODEM ODN OMG ONT
      PART PAX PAY PIVX PLR
    POLY PPC PPT PUM QASH QNT QTUM RDD REP REQ RLC RVN SALT SC
      SMART SNT STEEM
    STORJ STRAT SUB SYS TCT TEL TEN THETA TOMO TRX TUSD USDC USDT
      VET VTC WAN
    WAVES WAXP WGR WICC WTC XEM XLM XMR XRP XTZ XVG XZC ZEC
      ZEN ZIL ZRX;
run;


data work.&out._long2;
  set work.&out._long;
  crypto  = _NAME_;
  &metric = COL1;
  keep date crypto &metric;
run;
```

```
data work.&out._long3;
  set work.&out._long2;
  date_num = input(cats(date,'-01'), yymmdd10.);
  format date_num yymmdd10.;
run;


/* B. Merge treatment & subset pre-period */
proc sort data=work.&out._long3; by crypto; run;
data work.pre_&out;
  merge work.&out._long3 work.trt_long;
  by crypto;
  if date_num < '01MAR2020'd;
run;
proc sort data=work.pre_&out; by date_num; run;


/* C. Create time & interaction variables */
data work.pre_&out;
  set work.pre_&out;
```

```
  by date_num;

  retain period 0;

  if first.date_num then period + 1;

  period2 = period**2;

  period3 = period**3;

  DID   = period  * treatment;

  DID2  = period2 * treatment;

  DID3  = period3 * treatment;

  if &metric > 0 then &logm = log(&metric);

  else &logm = .;

run;



/* D. Aggregate for plotting */

proc means data=work.pre_&out noprint nway;

  class period treatment;

  var &logm;

  output out=work.agg_&out

    mean(&logm)=avg_&logm;
```

```
run;

/* E. Parallel-trends test */
proc surveyreg data=work.pre_&out;
  cluster crypto;
  model &logm = period period2 period3
              treatment DID DID2 DID3
  / solution;
  title "Pre-Treatment Trends: Log Avg &title by Group";
  /* joint test of baseline & slope differences */
  test treatment DID DID2 DID3;
run;

/* F. Plot */
proc sgplot data=work.agg_&out;
  series x=period y=avg_&logm / group=treatment markers;
  xaxis label="Period" integer values=(1 to 14 by 1);
  yaxis label="Log Avg &title";
```

```
  title "Pre-Treatment: Log Avg &title by Group";
 run;

%mend pretrend;

/* --- 4. Invoke macro for each series --- */
%pretrend(data=cap_data, out=cap, metric=market_cap, logm=log_mcap, title=Market
        Cap)
%pretrend(data=vol_data, out=vol, metric=volume,    logm=log_vol,  title=Volume)
%pretrend(data=prc_data, out=prc, metric=price,     logm=log_prc,  title=Price)
```

TWFE SCRIPTS (one per output variable):

```
/*
        ===============================================================
        =====
  CLUSTERED-SE  TWFE  –  Market-Cap  vs  Log(Market-Cap)

        ===============================================================
        ===== */
```

```
options nonotes nostimer nosource nosyntaxcheck;

title; footnote;


/*-------------------------------------------------------------------

  1 ▸ Import Excel sheets

-------------------------------------------------------------------*/

proc import datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

          out=mcap_raw dbms=xlsx replace;

   sheet="AdjustedMarketCap"; getnames=yes;

run;


proc import datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

          out=treat_raw dbms=xlsx replace;

   sheet="Treatment";       getnames=yes;

run;


/*-------------------------------------------------------------------

  2 ▸ Wide → long (market-cap)
```

```
------------------------------------------------------------------*/

data mcap_long;

   set mcap_raw;

   array coins {*} ADA--ZRX;

   do _i=1 to dim(coins);

      crypto     = vname(coins{_i});

      market_cap  = coins{_i};

      date_num    = input(cats(Ticker,'-01'),yymmdd10.);

      format date_num yymmdd10.;

      output;

   end;

   keep crypto market_cap date_num;

run;



/*------------------------------------------------------------------

  3 ▸ Attach treatment flag

------------------------------------------------------------------*/

proc transpose data=treat_raw
```

```
            out=treat_long(rename=(_NAME_=crypto col1=treatment));
   var ADA--ZRX;
run;


proc sort data=mcap_long ; by crypto;
proc sort data=treat_long; by crypto;
run;


data panel_full; merge mcap_long treat_long; by crypto; run;


/*---------------------------------------------------------------------
  4 ▸ Build analysis variables
---------------------------------------------------------------------*/
proc sort data=panel_full; by date_num; run;


data tdwfe;
   set panel_full;
   by date_num;
```

```
   retain period 0;

   if first.date_num then period+1;

   Stimulus = treatment*period;

   if market_cap>0 then log_market_cap=log(market_cap);

run;


/*---------------------------------------------------------------------

  5 ▸ Clustered-SE TWFE models (capture ODS)

---------------------------------------------------------------------*/

ods graphics off;

ods output ParameterEstimates=PE_Level FitStatistics=FS_Level;

proc surveyreg data=tdwfe;

   cluster crypto;

   class   crypto;

   model   market_cap     = period Stimulus crypto / solution adjrsq;

run;


ods output ParameterEstimates=PE_Log   FitStatistics=FS_Log;
```

```
proc surveyreg data=tdwfe;

   cluster crypto;

   class   crypto;

   model   log_market_cap = period Stimulus crypto / solution adjrsq;

run;



/*--------------------------------------------------------------------

  6 ▸ Macro: build one model column

--------------------------------------------------------------------*/

%macro BuildColumn(PE=, FS=, dep=, col=, out=);



   /* 6a ▸ Coefficient + SE rows ---------------------------------*/

   data _coef;

      set &PE(keep=Parameter Estimate StdErr Probt);

      Parm = upcase(Parameter);

      if Parm in ('PERIOD','STIMULUS','INTERCEPT');

      length RowLbl $30 Value $40 order 8;

      select (Parm);
```

```
      when ('PERIOD')    base=1;
      when ('STIMULUS')  base=3;
      otherwise          base=5;
   end;
   /* coefficient */
   order=base;
   RowLbl=propcase(strip(Parameter));
   Star = ifc(Probt<=.01,'***', ifc(Probt<=.05,'**', ifc(Probt<=.10,'*','')));
   Value=cats(put(Estimate,comma16.2),Star); output;
   /* SE */
   order=base+1; RowLbl=' '; Value=cats('(',put(StdErr,comma16.2),')'); output;
   keep order RowLbl Value;
run;

/* 6b ▸ Adj R-Sq & Wald F from FitStatistics (robust search) ----*/
%let _adj  = . ;
%let _fval = . ;
```

```
data _null_;

   set &FS end=last;

   length _txt $400 _numval $20;

   /* concat every character cell in row */

   array _c _character_;

   _txt=' ';

   do over _c; _txt=catx(' ',_txt,lowcase(_c)); end;



   /* first non-missing numeric cell in row */

   array _n _numeric_;

   _numval=' ';

   do over _n;

      if not missing(_n) then do; _numval=strip(put(_n, best.)); leave; end;

   end;



   if _numval ne ' ' then do;

      if index(_txt,'adj') and index(_txt,'sq') then

         call symputx('_adj', _numval, 'g');
```

```
      if index(_txt,'wald f') then
         call symputx('_fval', _numval, 'g');
   end;
   if last then call symputx('_done','1');
run;


/* 6c ▸ observation count ---------------------------------------*/
proc sql noprint;
   select put(count(&dep.),comma10.) into :_nobs trimmed
   from tdwfe where not missing(&dep.);
quit;


/* 6d ▸ assemble rows ------------------------------------------*/
data &out;
   set _coef;
   &col = Value;
   keep order RowLbl &col;
run;
```

```
   data extras;
      length RowLbl $30 &col $40 order 8;
      order=7;  RowLbl='Coin Fixed Effects';   &col='Yes';        output;
      order=8;  RowLbl='No. Obs';              &col="&_nobs";     output;
      order=9;  RowLbl='Adj. R-Square';        &col="&_adj";      output;
      order=10; RowLbl='Overall Significance'; &col="&_fval";     output;
   run;

   data &out; set &out extras; run;

   proc datasets lib=work nolist; delete _coef extras; quit;

%mend;

%BuildColumn( PE=PE_Level , FS=FS_Level , dep=market_cap     ,
          col=MarketCap    , out=Col_Level );
```

```
%BuildColumn( PE=PE_Log   , FS=FS_Log   , dep=log_market_cap ,
            col=LogMarketCap , out=Col_Log );


/*------------------------------------------------------------------
  7 ‣ Merge & export
------------------------------------------------------------------*/
proc sort data=Col_Level; by order;
proc sort data=Col_Log;   by order;
run;


data Table_Final(drop=order);
   merge Col_Level(rename=(RowLbl=Parameter))
        Col_Log (keep=order LogMarketCap);
   by order;
run;


proc format;
   value $rowlbl
```

```
      'Period'              ='Period'

      'Stimulus'            ='Stimulus'

      'Intercept'           ='Intercept'

      ' '                   =' '          /* SE rows */

      'Coin Fixed Effects'   ='Coin Fixed Effects'

      'No. Obs'             ='No. Obs'

      'Adj. R-Square'       ='Adj. R-Square'

      'Overall Significance' ='Overall Significance';

run;



ods excel file="/home/u63744808/MySAS/Cap.xlsx"

       options(embedded_titles='yes');

ods excel options(sheet_name='Clustered Results');



proc print data=Table_Final noobs label;

   var Parameter MarketCap LogMarketCap /

      style(header)={just=center}

      style(data)  ={just=center tagattr="type:String"};
```

```
   format Parameter $rowlbl.;

   label Parameter   ='Variables'

         MarketCap   ='Market Cap'

         LogMarketCap='Log Market Cap';

run;



ods excel close;



/*
        ======================================================================
        =====
  CLUSTERED-SE TWFE  –  Volume  vs  Log(Volume)


        ======================================================================
        ===== */

options nonotes nostimer nosource nosyntaxcheck;

title; footnote;



/*------------------------------------------------------------------
```

```
  1 ▸ Import Excel sheets

----------------------------------------------------------------------*/

proc import datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

        out=vol_raw dbms=xlsx replace;

   sheet="AdjustedVolume";     /* <<— changed  */

   getnames=yes;

run;



proc import datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

        out=treat_raw dbms=xlsx replace;

   sheet="Treatment";

   getnames=yes;

run;



/*----------------------------------------------------------------------

  2 ▸ Wide → long (volume)

----------------------------------------------------------------------*/

data vol_long;
```

```
   set vol_raw;
   array coins {*} ADA--ZRX;
   do _i=1 to dim(coins);
      crypto    = vname(coins{_i});
      volume    = coins{_i};
      date_num  = input(catx('-',Ticker,'01'), yymmdd10.);
      format date_num yymmdd10.;
      output;
   end;
   keep crypto volume date_num;
run;

/*-----------------------------------------------------------------
  3 ▸ Attach treatment flag
-----------------------------------------------------------------*/
proc transpose data=treat_raw
           out=treat_long(rename=(_NAME_=crypto col1=treatment));
   var ADA--ZRX;
```

```
run;

proc sort data=vol_long ; by crypto;
proc sort data=treat_long; by crypto;
run;

data panel_full; merge vol_long treat_long; by crypto; run;

/*----------------------------------------------------------------------
  4 ▸ Build analysis variables
----------------------------------------------------------------------*/
proc sort data=panel_full; by date_num; run;

data tdwfe;
   set panel_full;
   by date_num;
   retain period 0;
   if first.date_num then period+1;
```

```
   Stimulus = treatment*period;

   if volume>0 then log_volume = log(volume);

run;


/*---------------------------------------------------------------------

  5 ▸ Cluster-robust TWFE (coefficients + FitStatistics)

---------------------------------------------------------------------*/

ods graphics off;


ods output ParameterEstimates=PE_Vol

           FitStatistics      =FS_Vol;

proc surveyreg data=tdwfe;

   cluster crypto;

   class   crypto;

   model   volume     = Stimulus crypto period / solution adjrsq;

run;


ods output ParameterEstimates=PE_LogVol
```

```
      FitStatistics     =FS_LogVol;
proc surveyreg data=tdwfe;
  cluster crypto;
  class  crypto;
  model  log_volume = Stimulus crypto period / solution adjrsq;
run;


/*--------------------------------------------------------------------
  6 ▸ Macro: build one model column
--------------------------------------------------------------------*/
%macro BuildColumn(PE=, FS=, dep=, col=, out=);


  /* 6a ▸ coefficients + SE rows -------------------------------- */
  data _coef;
    set &PE(keep=Parameter Estimate StdErr Probt);
    Parm = upcase(Parameter);
    if Parm in ('PERIOD','STIMULUS','INTERCEPT');
    length RowLbl $30 Value $40 order 8;
```

```
  select (Parm);
    when ('PERIOD')   base=1;
    when ('STIMULUS') base=3;
    otherwise         base=5;
  end;
  /* coefficient */
  order=base;
  RowLbl=propcase(strip(Parameter));
  Star = ifc(Probt<=.01,'***', ifc(Probt<=.05,'**', ifc(Probt<=.10,'*','')));
  Value=cats(put(Estimate,comma16.2),Star); output;
  /* SE */
  order=base+1; RowLbl=' '; Value=cats('(',put(StdErr,comma16.2),')'); output;
  keep order RowLbl Value;
run;


/* 6b ▸ Adj R-Sq (robust scan) -------------------------------- */
%let _adj=. ;
data _null_;
```

```
    set &FS;
    array c _character_; array n _numeric_;
    _txt=' '; do over c; _txt=catx(' ',_txt,lowcase(c)); end;
    if index(_txt,'adj') and index(_txt,'sq') then do;
        _val=coalescec(of c[*]);
        if missing(_val) then do over n; if not missing(n) then _val=strip(put(n,8.4)); end;
        call symputx('_adj',_val,'g');
    end;
run;

/* 6c ‣ observation count ------------------------------------- */
proc sql noprint;
    select put(count(&dep.),comma10.) into :_nobs trimmed
    from tdwfe where not missing(&dep.);
quit;

/* 6d ‣ assemble rows ------------------------------------------ */
data &out;
```

```
    set _coef;
    &col = Value;
    keep order RowLbl &col;
  run;

  data extras;
    length RowLbl $30 &col $40 order 8;
    order=7;  RowLbl='Coin Fixed Effects'; &col='Yes';       output;
    order=8;  RowLbl='No. Obs';           &col="&_nobs";     output;
    order=9;  RowLbl='Adj. R-Square';     &col="&_adj";      output;
  run;

  data &out; set &out extras; run;
  proc datasets lib=work nolist; delete _coef extras; quit;

%mend BuildColumn;

%BuildColumn( PE=PE_Vol    , FS=FS_Vol    , dep=volume     ,
```

```
            col=Volume    , out=Col_Vol );


%BuildColumn( PE=PE_LogVol , FS=FS_LogVol , dep=log_volume ,

            col=LogVolume , out=Col_Log );


/*--------------------------------------------------------------------

  7 ▸ Merge & export

--------------------------------------------------------------------*/

proc sort data=Col_Vol; by order;

proc sort data=Col_Log; by order;

run;


data Table_Final(drop=order);

   merge Col_Vol(rename=(RowLbl=Parameter))

         Col_Log(keep=order LogVolume);

   by order;

run;
```

```
proc format;

   value $rowlbl

      'Period'              ='Period'

      'Stimulus'            ='Stimulus'

      'Intercept'           ='Intercept'

      ' '                   =' '          /* SE rows */

      'Coin Fixed Effects'   ='Coin Fixed Effects'

      'No. Obs'             ='No. Obs'

      'Adj. R-Square'       ='Adj. R-Square';

run;



ods excel file="/home/u63744808/MySAS/Vol.xlsx"

       options(embedded_titles='yes');

ods excel options(sheet_name='Clustered Results');



proc print data=Table_Final noobs label;

   var Parameter Volume LogVolume /

      style(header)={just=center}
```

```
    style(data)  ={just=center tagattr="type:String"};
  format Parameter $rowlbl.;
  label Parameter='Variables'
       Volume   ='Volume'
       LogVolume='Log Volume';
run;

ods excel close;

/*
   ======================================================================
   =====
  CLUSTERED-SE TWFE  –  Price  vs  Log(Price)

   ======================================================================
   ===== */
options nonotes nostimer nosource nosyntaxcheck;
title; footnote;
```

```
/*------------------------------------------------------------------

  1 ▸ Import Excel sheets

------------------------------------------------------------------*/

proc import datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

        out=price_raw dbms=xlsx replace;

   sheet="PriceVert";          /* <<— NEW sheet */

   getnames=yes;

run;



proc import datafile="/home/u63744808/MySAS/Capstone/Stimulus2-1.xlsx"

        out=treat_raw dbms=xlsx replace;

   sheet="Treatment";

   getnames=yes;

run;



/*------------------------------------------------------------------

  2 ▸ Wide → long (price)

------------------------------------------------------------------*/
```

```
data price_long;
   set price_raw;
   array coins {*} ADA--ZRX;
   do _i = 1 to dim(coins);
      crypto    = vname(coins{_i});
      price     = coins{_i};
      date_num  = input(catx('-',Ticker,'01'), yymmdd10.);
      format date_num yymmdd10.;
      output;
   end;
   keep crypto price date_num;
run;


/*------------------------------------------------------------------
  3 ▸ Attach treatment flag
------------------------------------------------------------------*/
proc transpose data=treat_raw
           out=treat_long(rename=(_NAME_=crypto col1=treatment));
```

```
   var ADA--ZRX;
run;

proc sort data=price_long ; by crypto;
proc sort data=treat_long; by crypto;
run;

data panel_full; merge price_long treat_long; by crypto; run;

/*------------------------------------------------------------------
  4 ▸ Build analysis variables
------------------------------------------------------------------*/
proc sort data=panel_full; by date_num; run;

data tdwfe;
   set panel_full;
   by date_num;
   retain period 0;
```

```
   if first.date_num then period+1;

   Stimulus = treatment*period;

   if price>0 then log_price = log(price);

run;



/*--------------------------------------------------------------------

  5 ▸ Cluster-SE TWFE  (coefficients + FitStatistics)

--------------------------------------------------------------------*/

ods graphics off;



ods output ParameterEstimates=PE_P

           FitStatistics      =FS_P;

proc surveyreg data=tdwfe;

   cluster crypto;

   class   crypto;

   model   price      = Stimulus crypto period / solution adjrsq;

run;
```

```
ods output ParameterEstimates=PE_LogP

        FitStatistics      =FS_LogP;

proc surveyreg data=tdwfe;

   cluster crypto;

   class   crypto;

   model   log_price  = Stimulus crypto period / solution adjrsq;

run;



/*---------------------------------------------------------------------

  6 ▸ Macro: build one model column

---------------------------------------------------------------------*/

%macro BuildColumn(PE=, FS=, dep=, col=, out=);



   /* 6a ▸ coefficient + SE rows ----------------------------------*/

   data _coef;

      set &PE(keep=Parameter Estimate StdErr Probt);

      Parm = upcase(Parameter);

      if Parm in ('PERIOD','STIMULUS','INTERCEPT');
```

```
   length RowLbl $30 Value $40 order 8;
   select (Parm);
      when ('PERIOD')   base=1;
      when ('STIMULUS') base=3;
      otherwise         base=5;
   end;
   order=base;
   RowLbl=propcase(strip(Parameter));
   Star = ifc(Probt<=.01,'***',ifc(Probt<=.05,'**',ifc(Probt<=.10,'*','')));
   Value=cats(put(Estimate,comma16.2),Star); output;
   order=base+1; RowLbl=' '; Value=cats('(',put(StdErr,comma16.2),')'); output;
   keep order RowLbl Value;
run;


/* 6b ▸ Adj R-Square ------------------------------------------*/
%let _adj=. ;
proc sql noprint;
   select coalescec(cValue1,cValue2,put(nValue1,8.4),put(nValue2,8.4))
```

```
    into :_adj trimmed
   from &FS
   where lowcase(Label) like '%adj%r%sq%';
quit;


/* 6c ‣ observation count -----------------------------------*/
proc sql noprint;
   select put(count(&dep.),comma10.) into :_nobs trimmed
   from tdwfe where not missing(&dep.);
quit;


/* 6d ‣ assemble rows -----------------------------------------*/
data &out;
   set _coef;
   &col = Value;
   keep order RowLbl &col;
run;
```

```
  data extras;
    length RowLbl $30 &col $40 order 8;
    order=7;  RowLbl='Coin Fixed Effects'; &col='Yes';       output;
    order=8;  RowLbl='No. Obs';          &col="&_nobs";     output;
    order=9;  RowLbl='Adj. R-Square';     &col="&_adj";      output;
  run;

  data &out; set &out extras; run;
  proc datasets lib=work nolist; delete _coef extras; quit;

%mend BuildColumn;

%BuildColumn( PE=PE_P    , FS=FS_P    , dep=price      ,
       col=Price    , out=Col_P );

%BuildColumn( PE=PE_LogP , FS=FS_LogP , dep=log_price  ,
       col=LogPrice, out=Col_Log );
```

```
/*-------------------------------------------------------------------

  7 ▸ Merge columns & export

-------------------------------------------------------------------*/

proc sort data=Col_P;   by order;

proc sort data=Col_Log; by order;

run;



data Table_Final(drop=order);

   merge Col_P (rename=(RowLbl=Parameter))

         Col_Log(keep=order LogPrice);

   by order;

run;



proc format;

   value $rowlbl

      'Period'           ='Period'

      'Stimulus'          ='Stimulus'

      'Intercept'         ='Intercept'
```

```
        ' '                    =' '        /* SE rows */
        'Coin Fixed Effects'   ='Coin Fixed Effects'
        'No. Obs'              ='No. Obs'
        'Adj. R-Square'        ='Adj. R-Square';
run;


ods excel file="/home/u63744808/MySAS/Price.xlsx"
         options(embedded_titles='yes');
ods excel options(sheet_name='Clustered Results');


proc print data=Table_Final noobs label;
   var Parameter Price LogPrice /
       style(header)={just=center}
       style(data)  ={just=center tagattr="type:String"};
   format Parameter $rowlbl.;
   label Parameter='Variables'
         Price     ='Price'
         LogPrice  ='Log Price';
```

```
run;

ods excel close;
```