Global Capital Markets and Cryptocurrency: Exploring the International Political Economy of Blockchain Ecosystems and Metaverse Development

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Abstract

Key contributions include 1) analytical dollar-denominated comparisons between blockchain/metaverse assets and fiat-denominated traditional markets, 2) comparative analysis of blockchain ecosystems both theoretically and empirically, and 3) demonstration of topic relevance to international relations, international political economy, and international development. The paper exploits public deep-order-book auction markets, allowing tick-to-tick observation of values of underlying assets (reminiscent of the early CRSP papers at Chicago), tethering the analysis to real prices paid in real markets.

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by Michael J. Bushnell

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Introduction

In February 2022, the *Japan Times* published an article chronicling Dominic Lumabi, a

26-year-old Filipino who lost his job at an advertising firm due to pandemic-related layoffs.[1]

Amidst an uncertain economic climate and decreased access to in-person income-earning

opportunities, Lumabi began playing an "internet game" called Axie Inifnity. Playing from home

for two hours daily, Lumabi earned 8,000 to 10,000 Philippine pesos (about $155 to $195) per

month, nearly half of what Lumabi made as a full-time content moderator working nine-hour

shifts. Lumabi is one of many to have recently discovered the lucrative nature of Axie Infinity's

play-to-earn economy.[2] Why work full-time for an employer when you can make just as much at

home playing a game on your own schedule? If adopted widely, what are the political and

economic implications for a country like the Philippines and, for that matter, the future of work

globally?

This is just one example revealing the unsung significance of blockchain ecosystems and

economic opportunities in the "metaverse" to international relations, specifically international

political economy. The accelerating relevance of the metaverse, an extension of the internet

transforming how individuals around the world work, communicate, and entertain themselves, as

the future of the global marketplace is unprecedented.[3] Estimates situate the 2021 market size of

the metaverse at approximately $210 billion, predicted to exceed $715 billion by 2027, growing

[1] Agence France-Press, "Life-changing' or scam? Axie Infinity helps Philippines' poor earn," *Japan Times*, February 16, 2022, https://www.japantimes.co.jp/news/2022/02/16/asia-pacific/axie-infinity-philippines-poor-earn/ (Accessed April 3, 2022).
[2] With nearly 3 million daily active users as of December 2021, 68% of participants think that Axie Infinity can potentially be a sustainable full-time job. Players earn an average of 151 – 200 SLP ($55.50) per day, equivalent to $1,665 a month, typically cashing out to fiat. Erina Azmi, "CoinGecko Axie Infinity Survey 2021," *CoinGecko*, July 26, 2021, https://www.coingecko.com/buzz/coingecko-axie-infinity-survey-2021 (Accessed April 3, 2022).
[3] The metaverse is like federalism: the definition depends on who you ask. For further discussion, see Appendix A.

at a staggering 22.7% CAGR during the 2021-2027 period.[4] This lofty valuation is nonetheless

dwarfed by multitrillion-dollar projections for the future of the metaverse economy.[5] Already,

economic opportunities in the metaverse rival those available in physical reality. As mentioned

above, play-to-earn gaming ecosystems provide above average wages for individuals in

struggling national economies while multinational corporations and government institutions alike

are investing significantly in metaverse strategies. Barbados, for example, has recently

established an official embassy in Decentraland, authorizing the declaration of sovereign land in

this environment,[6] which alone prompts critical questions for the integration of international

relations within the metaverse.

An optimist sees the metaverse as a tool for globalization, levelling the playing field of

international exchange by providing viable economic alternatives to existing opportunities. A

pessimist counters that the metaverse has the potential to exacerbate global inequality by

increasing firm heterogeneity and creating accessibility constraints for emerging markets, not to

mention complicating the question of sovereignty in a digitized society. A third group, perhaps

the largest, sees the metaverse as no more than a passing fad. If true, the extent to which the

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[4] Brand Essence Research, "Metaverse Market Size, Share, Companies & Trends Analysis Report By Component (Hardware {Display, EXtended Reality (XR)Hardware, AR/VR Headsets}, Software {Asset Creation Tools, Programming Engines}), By Type (Desktop, Mobile), By Offerings (Virtual Platforms, Avatars, Asset Marketplaces, Financial Services), By Technology (Blockchain, Virtual Reality (AR) & Augmented Reality (AR), Mixed Reality (MR)), By Application (Online Shopping, Gaming, Social Media, Content Creation, Conferences, Others), By End-User (Education, Fashion, Media & Entertainment, Aerospace & Defense, Other) Metaverse Industry Based On Region, And Segment Forecasts, 2021 – 2027," Published January 2022, https://brandessenceresearch.com/technology-and-media/metaverse-market-size (Accessed April 3, 2022).
[5] Knight, Robert, "Metaverse Economy Could Value up to $30 Trillion Within Next Decade," November 12, 2021, https://beincrypto.com/metaverse-economy-could-value-30-trillion-ina-decade/ (Accessed April 3, 2022).
[6] Andrew Thurman, "Barbados to Become First Sovereign Nation With an Embassy in the Metaverse," 15 November 2021, https://www.coindesk.com/business/2021/11/15/barbados-to-become-first-sovereign-nation-with-an-embassy-in-the-metaverse/ (Accessed 3 April 2022).

metaverse is tied to the global economy determines the scale and severity of a potential bubble, which again grants international political economy a seat at the table. These consequences among others warrant research toward understanding how the global economy relates to the metaverse economy, and further, an exploration of the forces that contribute to the metaverse's burgeoning economic opportunities.

At the core of the metaverse are blockchain ecosystems that employ cryptocurrency to incentivize development.[7] As such, this paper's empirical analysis employs a LASSO regression model to assess the significance of twenty-five global capital markets covariates[8] to the asset prices of cryptocurrencies for three of the world's largest blockchain ecosystems: Decentraland, ($MANA), Theta Network ($THETA), and Axie Infinity ($AXS). These ecosystems have been chosen as response variables in this study due to each being a uniquely significant use case of the nascent metaverse economy.[9] The empirical analysis indicates that certain global capital markets variables significantly relate to the price of these cryptocurrencies. This finding suggests that blockchain ecosystems are not shielded from global economic forces seeing as their valuations are not immune to traditional macroeconomic levers such as global capital markets. The significance of macroeconomic indicators to current use cases of the metaverse economy prompts a call to action for international relations scholarship to consider how the relationship between the global economy and the metaverse impacts relevant societal developments including but not limited to globalization, the future of work, and inequality within and between states.

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[7] For a brief primer on blockchain, see Appendix B.

[8] See Appendix C for the list of global capital markets regressors included in the empirical analysis.

[9] Axie Infinity is a play-to-earn game, the Theta Network is a content distribution platform, and Decentraland is a digital world compatible with virtual reality (VR) technology. Use case analysis will be discussed further in the Overview of Metaverse Cryptocurrencies and Methodology sections.

The significance of global capital markets to the metaverse economy illuminates a variety of implications inspiring a literature within the scope of international political economy. 1) It means traditional global economic indicators may help project and explain metaverse asset valuations. 2) It provides a starting point for understanding why the metaverse is a compelling opportunity for individuals and businesses alike. 3) Understanding what drives value in the metaverse economy informs potential regulatory policy. 4) The scale of metaverse economic opportunity is relevant to the global economy in that it creates jobs, applies upward pressure on non-metaverse incomes, and demonstrates the metaverse as an increasingly viable alternative investment vehicle that influences capital deployment in the global economy. 5) Concentrated significance may reveal geographic regionalization in the development of an economy of the metaverse, introducing a new academic arena for *metaverse political economy*.

Literature Review

The relevance of the metaverse to international relations scholarship, specifically the study of international political economy, is built on the premise that that this technology has, and will continue to, supplant the global marketplace in a way that impacts labor, communication, and social mobility around the world. As such, the starting point of this literature review is adaptive structuration theory, the notion that cutting-edge information technologies trigger adaptive structure processes that lead to changes in the rules and resources that create that technology.[10] Innovative technologies that change the nature of group collaboration change the way in which society works, communicates, and finds entertainment. This is because advanced information technologies introduce unprecedented modes of interaction in social structures that enable previously impossible efficiency of communication. Consider, how the evolution of communication technology, instant messaging for example, has contributed to the "death of distance" and rapid globalization.[11] The social, communicative, and economic impacts of new technology, and how the global dissemination of this technology affects international relations, is difficult to dispute.

Understanding the role of the metaverse in societal evolution requires historical context preceding the blockchain era. Before the rise of cryptographic technology, massively multiplayer online role-playing games (MMORPGs) foreshadowed the metaverse. These precursory virtual worlds presented individuals with unprecedented opportunity to earn income by contributing to a market-based infrastructure. The low barriers to entry, the rapidly expanding user base, and the

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[10] DeSanctis, Gerardine, and Marshall Scott Poole. "Capturing the complexity in advanced technology use: Adaptive structuration theory." Organization science 5, no. 2 (1994): 121-147.
[11] Cairncross, Frances. The Death of Distance. Cambridge: Harvard Business School Press. 1997.

vast opportunity to create new activities for which products and services can be bought and sold coupled with the geographical dispersion of the internet make the metaverse an emerging market of high entrepreneurial temperature.[12] For example, virtual property developer Anshe Chung became the first "metaverse millionaire" in 2007 as the first online identity to achieve a net worth exceeding $1 million from profits entirely earned inside the MMORPG *Second Life*.[13] The introduction of the world wide web created demand for web developers and web designers while virtual worlds like *Second Life* created demand for scripting developers and product designers. The metaverse, too, creates demand and marketplaces for previously undervalued skills and talents.[14]

Furthermore, the economic impact of the metaverse is not limited to virtual worlds. Adjustments in the business strategies of brick-and-mortar industries follows on from widespread adoption of metaverse. The intertwining of these spaces – that of physical and electronic environments – have prompted the rapid development of e-commerce and e-business since the mid-1990s.[15] Assuming rapid growth in the number of consumers who will spend significant time interacting with the metaverse, a new social and business environment emerges

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[12] Papagiannidis, Savvas, Michael Bourlakis, and Feng Li. "Making real money in virtual worlds: MMORPGs and emerging business opportunities, challenges and ethical implications in metaverses." *Technological Forecasting and Social Change* 75, no. 5 (2008): 610-622.

[13] This wealth consisted of a virtual portfolio of real estate equivalent to 36 square kilometers of land, 'cash' holdings of several million Linden dollars, many shopping malls, store chains, stocks in other *Second Life* companies and brands. See Parloff, Roger, "Anshe Chung Becomes First Virtual World Millionaire," *CNN*, November 27, 2006, https://money.cnn.com/blogs/legalpad/2006/11/anshe-chung-first-virtual-millionaire.html (Accessed April 20, 2022).

[14] For example, in a world where individual digital contributions were appropriately valued by society, video game enthusiasts could convert their enjoyment of gaming into a productive skill. See Posner, Eric A. and Weyl, E. Glen. *Radical Markets: Uprooting Capitalism and Democracy for a Just Society*. Princeton: Princeton University Press. 2018. p. 248-249.

[15] Lee, In. "What is E-business? How the Internet Transforms Organizations." International Journal of E-Business Research 3, no. 2 (2007): 83-85.

which incorporates not just physical and electronic spaces, but also multiple virtual spaces.[16] As a result, the metaverse creates new opportunities for promotion, personalization, and experience-oriented consumption to name a few examples.

Consider the case of retail. E-retailing, the introduction of the electronic space to the retail industry, radically reduced capital investment requirements for companies selling products in that brick-and-mortar establishments, and the real estate, employees, et cetera that accompany it, are swapped with websites that are cheaper to maintain and lower the transaction costs of the consumer.[17] However, this electronic transition loses one key dimension of retail appeal often referred to as 'retail theater,' the empirically warranted reality that consumers not only enjoy consuming the product, but enjoy the interaction and experience uniquely provided by the retail.[18] Although this is conventionally perceived as only being achieved via in-person retail experience, the metaverse captures this element of consumer experience through immersion. As the town square transitions to the metaverse, [19] traditional business and its impact on the global economy, and its labor force, is affected.

A consumer-driven flight to the metaverse not only affects multinational giants but also mom-and-pop shops scattered throughout various world markets facing what is already an uphill battle against technological advancement that naturally favors large, highly capitalized, global

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[16] B Bourlakis, Michael, Savvas Papagiannidis, and Feng Li. "Retail spatial evolution: paving the way from traditional to metaverse retailing." Electronic Commerce Research 9, no. 1 (2009): 135-148.
[17] Ibid.
[18] Harris, Kim, Richard Harris, and Steve Baron. "Customer participation in retail service: lessons from Brecht." International journal of retail & distribution management (2001).
[19] "Human life takes place increasingly online, and whereas people used to get meaning out of being seen promenading in the plaza in fancy clothes, now they get meaning out of being seen promenading on Twitter with fancy Bored Ape avatars, and we are finding ways to create artificial scarcity and gradations of status there and sell those gradations for a lot of money." From Freyman, Neal [Personal Interview]. *Matt Levine's MoneyStuff*. December 20, 2021.

businesses.[20] As is the case with any technology, the metaverse and its resulting economy has the

potential to exacerbate existing global inequality. The first application to consider is firm

heterogeneity, the league of separation between highly capitalized, multinational firms and

relatively small, domestic firms. Existing microdata reveals that firm participation in

international trade is exceedingly rare, pointing to fact that exporters and importers, in other

words multinational firms, represent a small fraction of producers in the global economy.[21]

These same studies find that exporters and importers are larger, more productive, more skill- and

capital-intensive, and pay higher wages prior to their entry into international markets than non-

trading firms. This inspires an obvious disadvantage for domestic firms in maintaining a

competitive foothold in their own home markets given the comparative advantage of larger, more

productive, more skilled multinational corporations.

This heterogeneity is exacerbated by information-oriented technology. In other words,

multinational corporations are becoming increasingly savvy at reaping business from smaller

firms. Empirical models suggest firm heterogeneity is endogenously reproduced through

technology adoption decisions.[22] Early adoption of metaverse technology may promote market

consolidation by granting multinational firms, already endowed with the resources necessary to

capitalize on technological innovations like the metaverse, a leg-up in terms of accumulating

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[20] Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott. "The empirics of firm heterogeneity and international trade." Annu. Rev. Econ. 4, no. 1 (2012): 283-313.
[21] Ibid.
[22] Ledezma, Ivan. "Product-market integration with endogenous firm heterogeneity." Oxford Economic Papers 73, no. 3 (2021): 1345-1368.

market share. Already, metaverse strategies are undergoing mainstream adoption across a broad range of industries.[23]

If metaverse technology increases firm heterogeneity, that heterogeneity may spill over to exacerbate global inequality at the population level. Empirical evidence suggests that rising global inequality at the population level is more so accounted for by firm heterogeneity than pay differences within employers.[24] Assuming this trend continues, large multinational firms endowed with the resources to capitalize on emerging metaverse technology will increase the divide that exists between their highly skilled employees and those who do not work for one of these companies. The fallout from this may involve the solidification of existing political and social cleavages that cross national boundaries created as a byproduct of globalization. Furthermore, increased disenchantment associated with those who are not employed by large, multinational corporations has the potential to inspire deeper class divides and even political conflict. As such, this is a scenario that must be considered by scholars of international political economy and policy makers working to mitigate rising global inequality.

Another application to consider is that business owners in emerging markets are particularly vulnerable to this impact. Literature on private equity in emerging markets, particularly regarding the contrast between businesses in high- versus low-income countries, illustrates this potential. Unlike large economies, emerging market economies are not endowed with a saturation of skilled talent necessary to compete on the cutting edge of metaverse technological development. Without exception, the empirical and anecdotal evidence

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[23] Ann-Marie Alcántara, "Marketers Explore Metaverse Worlds," *The Wall Street Journal*, March 2 2022. https://www.wsj.com/articles/marketers-explore-metaverse-worlds-11646218800 (Accessed April 3 2022).

[24] Song, Jae, David J. Price, Fatih Guvenen, Nicholas Bloom, and Till Von Wachter. "Firming up inequality." *The Quarterly journal of economics* 134, no. 1 (2019): 1-50.

overwhelmingly suggests that emerging market countries suffer from a shallow pool of skilled

professionals in almost every category compared to their developed country counterparts.[25]

Furthermore, firms in developing countries are often skeptical of strategic advice from

foreigners.[26] This literature reinforces the probability that the metaverse has the potential to

deepen global inequality.

That being said, the metaverse also creates tremendous opportunities for business owners

around the world to compete with multinational firms by adopting what should be a

democratizing, globalizing technology. Between 1820 and 1990, the share of world income

going to today's wealthy nations climbed from twenty percent to almost seventy percent. That

share has since plummeted to where it was in 1900. Scholars such as Richard Baldwin attribute

this change in direction to a new age of globalization defined by the democratizing effects of

information technology.[27] The metaverse as an evolution of information technology, assuming

the validity of Baldwin's argument, has the potential to further level the playing field. In

addition, the decentralized nature of metaverse technology alleviates entry barriers and

transaction costs brought on by institutional governance. For example, the blockchain eliminates

the need to pay intermediaries like banks to store or legitimize transaction agreements as this is

automatically audited on chain.[28] Based on this evidence, metaverse technology may

democratize information and economic opportunity in a way that advantages small but

enterprising individuals and firms over multinational corporations.

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[25] Leeds, Roger. *Private Equity Investing in Emerging Markets*. "Comparing Private Equity Ecosystems." 2003. p. 79.
[26] Ibid.
[27] Baldwin, Richard.The Great Convergence: Information Technology and the New Globalization. Cambridge, MA: Harvard University Press, 2016
[28] Liu, Jing, and Zhentian Liu. "A survey on security verification of blockchain smart contracts." *IEEE Access* 7 (2019): 77894-77904.

Additionally, the rising popularity of metaverse technology and metaverse worlds has increased barriers to entry. In worlds where the "cost of living" is determined by the price of its currency, high popularity drives up overhead associated with entering and existing in the market. For example, consider Axie Infinity, one of the virtual worlds examined as a case in this paper's empirical analysis. As of July 2021, floor price of an Axie[29] was roughly $230, and before you start playing Axie Infinity, you need to acquire at least 3 Axies, which would amount to at least $690 in total.[30] This argument applies to other assets in popular metaverses as the more popular a metaverse platform becomes, more money can be made at the expense of assets in the world becoming more expensive.[31] This creates an environment ripe for monopoly in which early entrants to a metaverse world have natural cost of capital advantages unregulated by trust laws that exist in government-monitored economies.[32]

This is why regulation and governance in the metaverse, although not a subject deeply explored by this paper, is particularly significant to the study of international political economy. Approaches to metaverse regulation vary internationally. In the status quo, international organizations, national governments, and the public sector more broadly have begun sketching

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[29] Axies are nonfungible tokens (NFTs), represented as whimsical creatures modeled after the axolotl, with unique genetic characteristics ensured by blockchain technology that players collect, breed, and battle incentivized by in-game rewards. *Official Axie Infinity Whitepaper*. Last updated November 2021. https://whitepaper.axieinfinity.com/ (Accessed April 3 2022).

[30] 62% of users agree that the cost of Axies is a high barrier of entry. Erina Azmi, "CoinGecko Axie Infinity Survey 2021," CoinGecko, July 26 2021, https://www.coingecko.com/buzz/coingecko-axie-infinity-survey-2021 (Accessed April 3, 2022).

[31] For example, in Decentraland, another world of study to this paper, the cheapest plots of virtual real estate cost roughly $10,000. The Decentraland Marketplace. https://market.decentraland.org/lands?assetType=nft&section=land&isMap=false&isFullscreen=false&vendor=decentraland&page=1&sortBy=cheapest&onlyOnSale=true&viewAsGuest=false&onlySmart=false (Accessed April 5 2022).

[32] Ron Shevlin, "Digital Land Grab: Metaverse Real Estate Prices Rose 700% In 2021," *Forbes*, February 4 2022, https://www.forbes.com/sites/ronshevlin/2022/02/04/digital-land-grab-metaverse-real-estate-prices-rose-700-in-2021/?sh=14c7b63c7cdc (Accessed April 3, 2022).

visions for a regulated metaverse. For example, the World Wide Web Consortium (WC3) recently instituted a Metaverse Interoperability Community Group with a mission to "bridge virtual worlds by designing and promoting protocols for identity, social graphs, inventory, and more."[33]

State governments have taken drastically different stances when it comes to the role of government institutions in building out metaverse regulations. While governments like Seoul and Barbados are embracing and building a more centralized vision of the metaverse with government at its center,[34] [35] others like the United States and China are wary of its adoption. If the latter philosophy prevails, and state governments remove themselves from the conversation around governing the metaverse, that privilege may fall to companies and other private sector organizations. Meta, for example, announced several governmental and nonprofit partnerships, including Peres Center for Peace and Innovation in Israel, that will collaborate on how to build the metaverse responsibly.[36] The implication that Meta will be an authoritative force in the metaverse is dubious given the company's less-than-successful track record in the crypto and payments space,[37] not even to mention Facebook's extensive history of regulatory and privacy

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[33] WC3 Team, "Call for Participation in Metaverse Interoperability Community Group," *W3C Community and Business Groups*, April 27, 2021, https://www.w3.org/community/metaverse-interop/ (Accessed April 3, 2022).

[34] Ye He Lee, Michelle, "Seoul wants to build a metaverse. A virtual New Year's Eve ceremony will kick it off," *The Washington Post*, November 28, 2021, https://www.washingtonpost.com/world/asia_pacific/metaverse-seoul-virtual/2021/11/27/03928120-4248-11ec-9404-50a28a88b9cd_story.html (Accessed April 3, 2022).

[35] Wyss, Jim, "Barbados Is Opening a Diplomatic Embassy in the Metaverse," *Bloomberg*, December 14, 2021, https://www.bloomberg.com/news/articles/2021-12-14/barbados-tries-digital-diplomacy-with-planned-metaverse-embassy (Accessed April 3, 2022).

[36] Dundas, Katie. "What is the Metaverse." *TechRadar*, November 23, 2021, https://www.msn.com/en-us/news/technology/what-is-the-metaverse/ar-AAQXdKh (Accessed April 3 2022).

[37] Meta's Libra project, for example, failed miserably. See Knowles, Tom, "Facebook's libra cryptocurrency project ends in failure," *The Times*, January 28, 2022, https://www.thetimes.co.uk/article/facebooks-libra-cryptocurrency-project-ends-in-failure-

concerns.[38] Given the plethora of legal concerns accompanying metaverse development, including but not limited to privacy, commerce, misinformation, and fraud, this point has massive social and economic implications.

The potential of metaverse technology to exacerbate economic and political inequality, not to mention regulatory contention, should be of special significance to scholars of international political economy. As such, this paper's empirical analysis will provide a statistical basis for the relationship between the global and metaverse economies that will inspire launch points for further exploration.

cxvnnc3kx#:~:text=It%20was%20once%20promoted%20as,project%20has%20ended%20in%20failure. (Accessed April 20, 2022).

[38] Tuttle, Hilary. "Facebook scandal raises data privacy concerns." *Risk Management* 65, no. 5 (2018): 6-9.

Overview of Metaverse Cryptocurrencies

        Three cryptocurrencies have been chosen as case studies in this paper's empirical analysis on the basis of their respective use cases in the metaverse. Axie Infinity is a play-to-earn game, Theta Network is a content creation and streaming platform, and Decentraland is a virtual reality world. Play-to-earn gaming, content distribution, and virtual reality are among the early applications of metaverse technology that have already gained traction around the world.[39] These three blockchain ecosystems are some of the largest players in these three burgeoning applications of metaverse development according to market capitalization.[40] The differences in significant regressors between these three cases will reveal potentially non-obvious stakeholders unique to each facet of the early metaverse economy. A discussion of each cryptocurrency in this study, and each use case represented, will corroborate their relevance to international political economy.

Axie Infinity ($AXS)

        Axie Infinity is a blockchain-based play-to-earn game universe released in 2018 created by Vietnam-based game developer Sky Mavis. The Axie Infinity universe is sustained by a player-owned economy in which players "battle, breed, collect, raise, and build kingdoms" to earn Ethereum-based cryptocurrency through "skilled-gameplay and contributions to the

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[39] This is not to say that these are the only use cases gaining traction. This study capitalizes on these three use cases in particular because the three metaverse cryptocurrencies of interest representing these applications have traits conducive to robust empirical analysis including but not limited to 1) large market capitalization, 2) deep order books warranted by relatively high daily trading volume, and 3) early establishment, enough to have relatively efficient market-based price movements in the 2021 calendar year. For a brief side-by-side comparison of relevant metrics to these ecosystems, see Appendix D.
[40] See Appendix E for a brief discussion on the distinction between market capitalization for a cryptocurrency versus that of a company.

ecosystem."[41] As of December 31st, 2021, the market capitalization of Axie Infinity stood at approximately 5.7 billion with about $200 million in daily transaction volume.[42]

The idea purported in the Axie Infinity white paper of a "player-owned economy" warrants further explanation. What does it mean for market participants to "own" the economy? An easy yet unsatisfying answer is blockchain technology that allows for non-fungible ownership of game assets through tokenization. However, a historical account of shared ownership in business organizations creates for an interesting application of the "player-owned" aspect of Axie Infinity's economy to economic development. Much like a mutual company,[43] Axie Infinity constitutes a payout model that essentially rewards players who play the game well with a higher share of ownership of the economy. The primary mechanism for redistribution of gains is constrained by the rules of the game itself. In this way, Axie Infinity is a sort of new-age savings club redefined by a tokenized payout structure and governance. This is what separates Axie Infinity from a platform like Decentraland which has no terminal use case or stringent constraints on the payout model.

Axie Infinity's nearly $6 billion player-owned economy is an ecosystem of interest to this paper's empirical analysis due, in part, to its characterization as a *digital nation*. Sky Mavis describes the game universes it creates as "Games with real, player-owned economies [that] will

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[41] *Official Axie Infinity Whitepaper*. Last updated November 2021. https://whitepaper.axieinfinity.com/ (Accessed April 3 2022).
[42] Per CoinMarketCap. See Appendix D.
[43] "Mutual Company" in JOHN DOWNES & JORDAN GOODMAN, DICTIONARY OF FINANCE AND INVESTMENT TERMS (Barrons 2014) (A mutual company is a "corporation whose ownership and profits are distributed among members in proportion to the amount of business they do with the company."). For more, see Muth, Karl T. and Leventhal, Andrew, "Mutuals: An Area of Legal Climate Change," William and Mary Business Law Review volume 9, number 597, 2018).

become places where we live, work, and play – true digital nations."[44] The ecosystem's

popularity and market capitalization have propelled Axie Infinity to unprecedented heights for a

blockchain-based, player-owned economy. The concept of a digital nation, not to mention the

unprecedented volume of individuals around the world who earn income from the platform,

including players and investors, underscores the significance of identifying the global capital

markets levers that relate to its value.

Although Axie Infinity was released in March 2018, the platform expanded quickly

during the pandemic in developing nations as COVID-19 forced individuals into isolation and

erased jobs. The game has gained traction in Indonesia, Venezuela, Vietnam, Brazil, and the

Philippines.[45] As a result, there are several geographically diversified stakeholders in Axie

Infinity's sizeable player-owned economy. In addition to the players themselves, AXS is held by

more than 55,000 wallets.[46] The developer Sky Mavis earns revenue from the game through in-

game transactions and marketplace fees. To date, Axie Infinity has generated more than $1.2

billion in revenue and has attracted highly capitalized investors including U.S. billionaire Mark

Cuban.[47]

The response variable representing Axie Infinity in this paper's empirical analysis is the Axie

Infinity Shard ($AXS). The AXS is a governance token rather than an in-game currency and has

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[44] The site homepage continues: "We're nation-builders. We build both the virtual worlds of the future and the infrastructure that makes them possible." Sky Mavis, "Blockchain Gamified," https://skymavis.com/ (Accessed April 6 2022).
[45] Lyllah Ledesma, "Axie Infinity Finds Ready Players in Hyperinflation-Racked Venezuela," *CoinDesk*, 23 November 2021, https://www.coindesk.com/markets/2021/11/23/axie-infinity-finds-ready-players-in-hyperinflation-racked-venezuela/ (Accessed 3 April 2022).
[46] Etherscan, "Token: Axie Infinity Shard," https://etherscan.io/token/0xbb0e17ef65f82ab018d8edd776e8dd940327b28b (Accessed April 6, 2022).
[47] Andrew Hayward, "Mark Cuban Joins Ethereum NFT Game Axie Infinity's $7.5 Million Raise" *Decrypt*, 11 May 2021, https://decrypt.co/70554/ethereum-nft-game-axie-infinity-mark-cuban-alexis-ohanian (Accessed 3 April 2022).

been chosen as the metric of analysis in this study over Smooth Love Potion ($SLP), the in-game

currency, because AXS represents the value of the economy as an asset rather than a primarily

transactional currency for the following reasons. AXS is finite in supply and captures investor

sentiment whereas SLP is prolific in supply and mainly linked to new market entrants. [48] One

does not need to play the game directly to buy AXS, reflecting the asset's utility as a market-

based pricing of Axie Infinity's economy. This makes AXS a better measure for the purpose of

this paper's empirical analysis than SLP when testing the effect of global capital market

variables on the price of Axie Infinity's virtual economy.

There are risks associated with blockchain-based play-to-earn platforms, specifically

Axie Infinity. In an interview with the *Japan Times*, Jonathan Teplitsky of blockchain firm

Horizen Labs warned most play-to-earn games were a "house of cards," fueled by "hype and

price speculation." Teplitsky continues: "This entire system works well while the Axie company

is flush with cash and willing to fuel a massive marketing machine," he said. "If Axie wants to

survive the next market crash, they will need to build some real-world utility into their game that

does not depend on the mood of the markets."[49] Teplitsky identifies a concerning attribute of this

burgeoning ecosystem to players and investors alike: growing the Axie Infinity economy relies

heavily on new entrants to the market. To start playing, users must purchase three "axis" which

can be bought, sold, or rented to other players. Owners can "breed" these Axies to create new

axies, adding value to the ecosystem in the form of new NFTs to buy, sell, rent, or earn value

[48] Jan Baeriswyl, "Understanding P2E 2.0: Axie Infinity Deep Dive," *Outlier Ventures*, July 2021, https://outlierventures.io/research/understanding-p2e-2-0-axie-infinity-deep-dive/#:~:text=Whereas%20SLP%20has%20an%20unlimited%20supply%2C%20AXS%20is,which%20is%20subsequently%20added%20to%20the%20community%20treasury (Accessed 3 April 2022).
[49] Agence France-Press, "Life-changing' or scam? Axie Infinity helps Philippines' poor earn," *Japan Times*, February 16, 2022. https://www.japantimes.co.jp/news/2022/02/16/asia-pacific/axie-infinity-philippines-poor-earn/ (Accessed April 3, 2022).

from in battles. Although Axies can be sold at whatever price users are willing to pay given how their genetic characteristics yield earnings potential, even the cheapest Axies present a high barrier to entry,[50] especially for low-income or unemployed players.

This poses two implications for the sustainability of the ecosystem's economy. First, this barrier to entry begs questions surrounding accessibility of the market. Given the platform's popularity in emerging markets, this cost-barrier may reinforce structural inequality if adoption of Axie Infinity becomes even more widespread. Better Axies means a higher probability of winning battles to earn in-game currency. This capital-associated barrier to entry creates in-game inequality that translates to differences in return on investment for players. According to the *Japan Times*, those with the capital to assemble more powerful Axie teams have set up guilds and "scholarships" — profit-sharing systems where players are charged a percentage of their earnings, which can go as high as 30%. Yield Guild Games, one of these companies offering scholarships to Axie Infinity, has 8,000 scholars and a 60,000-person waitlist that offers training and mentoring to a limited number of players at a time, adding to the mix of stakeholders in the ecosystem.[51]

Preceding this question is the prerequisite question of whether the Axie Infinity economy is sustainable in the first place. A vulnerability is exposed in that if market entrance dissipates, demand for Axies, the basis for the entire economy, will fall. This is key to the significance of this paper's empirical analysis. The way in which AXS, the game's governance token, behaves relative to other markets may inform the way in which economists and policymakers understand the asset class relative to the global economy. Given the magnitude of individuals and capital

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[50] Ibid.
[51] Ibid.

staked in the platform, a contextualization of what drives value in the Axie Infinity economy is foundational to future research surrounding the conceptualization of blockchain-based play-to-earn digital nations in the study of international political economy.

The case of Axie Infinity is particularly interesting given heavy participation in its economy on behalf of emerging markets. Play-to-earn games like Axie Infinity are becoming an increasingly viable alternative to to traditional economic opportunities. Approximately 40% of Axie Infinity's 110,000 active online players come from the Philippines, with Venezuela, Thailand, and Brazil in the high single digits.[52] That means that at any given moment, approximately 50,000 Filipinos, approximately 0.05% of the population, are working, earning, and living in this metaverse economy theoretically separate from the physical world. Three implications of this data provide striking commentary on the status quo of the physical economy versus the metaverse economy. 1) This trend is indicative of a lack of economic opportunity in the physical emerging markets from which players, absent the metaverse, would work and live. 2) Individuals in unsteady currency markets like the Philippines and Venezuela are taking refuge in growing cryptocurrency markets, spelling a dire outlook for the future of fiat currency. 3) Emerging markets are losing skilled labor to the metaverse economy.

Theta Network ($THETA)

The Theta ecosystem, operated by Theta Labs in Cupertino, California, seeks to be the premier media and entertainment blockchain platform. Theta is an end-to-end, decentralized video and data delivery network that leverages underutilized user devices to efficiently distribute

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[52] "Axie Infinity Live Player Count - How Many People Are Playing Now?" https://playercounter.com/axie-infinity/ (Accessed 3 April 2022).

data by repurposing excess bandwidth that would not otherwise be used.[53] Employing otherwise

unutilized resources, the Theta network provides high-quality video streaming at reduced costs in

comparison to traditional streaming service providers. Contributors of said bandwidth are

rewarded through shared ownership in the network. This is achieved through a synergy of

incentive mechanisms to maintain the network, enabled by the Theta token, for decentralized

bandwidth and content-sharing.[54] The response variable representing Theta in this essay's

empirical analysis is the Theta token, a protocol-level token used to secure and power the

blockchain. The Theta token incentivizes development, maintenance, and day-to-day operation

of Theta's blockchain. As of December 31st, 2021, the market capitalization of the Theta

Network stood at roughly $4.7 billion with approximately $163 million in daily transaction

volume.[55]

Theta is a different kind of "metaverse" platform compared to Axie Infinity or

Decentraland. Despite not being a digital world, per se, the Theta ecosystem is an unprecedented

evolution in media and video streaming, a wide industry that intersects with international

political economy in many ways. According to the Industry Research Co. "The global

entertainment and media market is expected to reach approximately USD $6.7 trillion by 2030,

registering a CAGR of 10.40% during the forecast period."[56] Numerous papers discuss the

importance of entertainment media to international political economy, including how specific

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[53] The utility of data sharing has been foreshadowed by projects that precede the Theta Network. Folding@Home, for example, harnesses the power of distributed computing to simulate protein dynamics. See https://foldingathome.org/?lng=en-US.
[54] Theta Labs, *Theta Whitepaper 3.0*, December 2020, https://s3.us-east-2.amazonaws.com/assets.thetatoken.org/Theta-white-paper-3-0-latest.pdf (Accessed 3 April 2022).
[55] Per CoinMarketCap. See Appendix D.
[56] Theta Labs, *Theta Ecosystem 2022 & TDROP Token White Paper*, August 2021, https://s3.us-east-2.amazonaws.com/assets.thetatoken.org/Theta-Ecosystem-2022-and-TDROP-Whitepaper.pdf?v=1628195175.16 (Accessed 3 April 2022).

industrial practices globally relate to international political economy[57] and how the power and influence of digital media transforms communication markets[58] and domestic political outcomes.[59]

The Theta blockchain is nearing complete implementation.[60] The ecosystem plans to capture market share by partnering with popular video platforms integrated with Theta's peer-to-peer (PSP) streaming services. Existing partners include World Poker Tour, GFUEL, and CONtv Anime among others. Aside from partners, there are several stakeholders in the Theta Network that demonstrate its relevance to a series of globally diversified actors. These include stakeholders at individual and institutional levels. Relevant individuals include live streamers, over-the-top video platforms, and other contributors that provide the excess bandwidth to Theta for data delivery. The Theta token holders that operate the underlying blockchain benefit from this incentive – more unutilized bandwidth for the ecosystem means a higher aptitude for the ecosystem's data delivery.

Stakeholders also include large multinational media and entertainment corporations. The Theta Network blockchain is, in part, governed by what Theta Labs calls "enterprise validators." A key function of the enterprise validators is establishing leadership and credibility with corporate partners. Google, Sony, CAA, Blockchain.com, and Samsung are among the multinational corporations acting as enterprise validators. The fact that large multinational corporations act as enterprise validators in the Theta ecosystem demonstrates the relevance of the

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[57] Lotz, Amanda D., and Horace Newcomb. "The production of entertainment media." In *A Handbook of Media and Communication research*, pp. 75-92. Routledge, 2020.

[58] Hardy, Jonathan. *Critical political economy of the media: An introduction*. Routledge, 2014.

[59] Der Derian, James. *Virtuous war: Mapping the military-industrial-media-entertainment-network*. Routledge, 2009.

[60] This means the focus of the ecosystem will soon shift from developing the protocol to accelerating network adoption: See Theta Ecosystem 2022 & TDROP Token White Paper.

network, and the stakes of the network's success, to many groups of actors in the global economy.

External to the implications of the model discussed in the paper's empirical analysis, a mere discussion of the Theta ecosystem and its unprecedented network-based media distribution platform is relevant to international political economy in its potential to democratize access to and ownership of data distribution networks. Token ownership in a network as opposed to share ownership in a company implies that the Theta ecosystem will be governed by its stakeholders in a way that is drastically different than the industry's status quo. As it stands, the global media industry is remarkably centralized. In comparison to a system in which large multimedia conglomerates dominate the global media landscape, where decision-making authority is granted only to those who are privy to each conglomerate's board of directors, the model of network ownership written by Theta indicates that the future of media production will look much more democratized and decentralized. This is largely attributable to the governance differences between an entity beholden to shareholders versus an entity beholden to token holders of the network itself.

While media conglomerates have shareholders, Theta is sustained through its token holders. Although this may seem similar to stock ownership at first glance, ownership over a network is distinctly different than ownership over a company. Consider the case of Sir Tim Berners-Lee, inventor of the hyptertext document management system accessible through the Internet that ultimately became the World Wide Web. This, like Theta, is a network. However, the World Wide Web cannot be "owned," at least in a verifiable sense. Although you can "own" component parts of the World Wide Web in the form of the physical infrastructure like cables and satellites to the virtual structures like websites, these component parts are useless without

connection through the Internet's network. Token ownership in the Theta Network, by contrast, is possible through blockchain technology.

The accessibility of Theta token ownership and the ability of individuals to own a stake in its network is relevant to international political economy. Theoretically, anyone can buy a share of a Theta token, entitling them to partial ownership of the network. Imagine if individuals could stake ownership of the Internet as it was being developed. As such, exploring the relationship between global capital markets and the Theta Network in terms of what drives value in the Theta token is important for the owners of this network, from individuals to multinational corporations. In a world where media is so important, this has implications that go beyond Theta alone. Specifically, the narrative above implies a democratization of the media landscape that has the potential to fundamentally change what and how media gets distributed. The token structure enables individuals to "crowdfund" projects they find interesting. At the end of the day, this, in part, bridges the divide between consumers and producers of media content by granting more leverage to the consumer as an authoritative agent in the network with a lower cost barrier to entry than the status quo.[61]

Decentraland ($MANA)

Decentraland is a virtual reality (VR) platform created by Argentinian entrepreneurs Ari Meilich and Esteban Ordano. Although the platform has been in development since 2015, the relevance of the browser-based "game" environment exploded in 2021. As of December 31st, 2021, Decentraland's ($MANA) market capitalization stood at a little over $5.9 billion with

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[61] For example, *most* of its users cannot afford to buy Twitter…

approximately $500 million in daily transaction volume.[62] MANA is Decentraland's in-game

currency and the response variable of this case's empirical analysis. The MANA token allows

Decentraland's users to create and monetize content. Individuals who own and operate digital

land, as well as individuals who create wearables and other purchasable NFTs, earn income from

the platform. Decentraland generates revenue by issuing and holding its MANA tokens. During

its ICO, the platform raised $26 million.[63]

In Decentraland, a user can explore 90,601 equal-size (33x33 feet) individual plots of

virtual land through a virtual avatar. Much like commercial real estate in the "real world,"

owners of digital land parcels in Decentraland can generate revenue from their property in a

variety of ways including advertising, retail, and gaming. Although other digital platforms such

as Roblox, Minecraft, and Fortnite have a similar look and feel, there is one crucial attribute that

separates Decentraland from these other applications: the ability for individuals to actually own

slices of the virtual world as NFTs.[64] When Decentraland was launched in 2017, digital land

parcels of the virtual world were sold for about $20 each. In November 2021, land parcels have

been sold at market for as much $2.43 million.[65]

Decentraland is increasingly becoming the frontier for mainstream integration of the

metaverse. In November 2021, for example, Barbados became the first sovereign nation to open

[62] Per CoinMarketCap. See Appendix.

[63] Higgins, Stan, "$26 Million: Blockchain VR Project Decentraland Raises New Funding in ICO," *CoinDesk*, August 18, 2017, https://www.coindesk.com/markets/2017/08/18/26-million-blockchain-vr-project-decentraland-raises-new-funding-in-ico/ (Accessed April 20, 2022).

[64] John Herrman and Kellen Browning, "Are We in the Metaverse Yet," October 29, 2021, https://www.nytimes.com/2021/07/10/style/metaverse-virtual-worlds.html (Accessed April 3, 2022).

[65] Anthony Cuthbertson, "Virtual land within metaverse sells for record $2.43 million," November 29, 2021, https://finance.yahoo.com/news/virtual-land-within-metaverse-sells-125953699.html#:~:text=A%20500%2Dsquare%2Dmetre%20plot,within%20a%20virtual%20reality%20world (Accessed April 3, 2022).

an official government-sponsored embassy in the metaverse by buying a plot of land in Decentraland.[66] The digital real estate upon which the embassy exists has been legally declared by Barbados as sovereign land. The Barbadian Ministry of Foreign Affairs and Foreign Trade executed the arrangement. In addition to Decentraland, Barbados is finalizing agreements with alternative metaverse platforms similar in operability to Decentraland, including but not limited to Somnium Space and SuperWorld.

The establishment of an embassy by a sovereign nation in Decentraland, not to mention the authorized declaration of sovereign land in its environment, begs crucial questions and implications for the integration of international relations within the metaverse. Article 22(1) of the Vienna Convention on Diplomatic Relations provides that, "The premises of the mission[67] shall be inviolable. The agents of the receiving State may not enter them, except with the consent of the head of the mission."[68] The establishment of an embassy in Decentraland throws a wrench not only in this tenant of international law, but even more importantly, sets a precedent going forward with regard to the establishment of virtual embassies in the metaverse. If Decentraland continues embodying a leading role on this legal and political frontier, forging a role for discussion of the platform in international political economy literature is of utmost importance.

Pricing of NFTs is a burgeoning arena for scholarly literature. As the market for NFTs grows, encompassing both individual and institutional investors, there exists an accelerating

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[66] Andrew Thurman, "Barbados to Become First Sovereign Nation With an Embassy in the Metaverse," 15 November 2021, https://www.coindesk.com/business/2021/11/15/barbados-to-become-first-sovereign-nation-with-an-embassy-in-the-metaverse/ (Accessed 3 April 2022).
[67] Article 1(i): "[t]he 'premises of the mission' are the buildings or parts of buildings and the land ancillary thereto, irrespective of ownership, used for the purposes of the mission including the residence of the head of the mission."
[68] James Cooper, "Towards the Metaverse: First thing we do, let's grill all the lawyers," 21 January 2022, https://thehill.com/opinion/technology/590319-towards-the-metaverse-first-thing-we-do-lets-grill-all-the-lawyers (Accessed 3 April 2022).

demand for information regarding how this market behaves. However, the NFT marketplace is recent and unprecedented, a Wild West of sorts for even the most sophisticated investors. For example, the price of $LAND, Decentraland's land based NFT asset class, is characterized by market inefficiency.[69] The relationship between NFTs and cryptocurrency is undeniably important to Decentraland:

> "A spillover index shows only limited volatility transmission effects between cryptocurrencies and NFTs. But wavelet coherence analysis indicates co-movement between the two sets of markets. This suggests that cryptocurrency pricing behaviours might be of some benefit in understanding NFT pricing patterns. However, the low volatility transmissions also indicate that NFTs can potentially be considered as a low-correlation asset class distinct from cryptocurrencies."[70]

This field of literature contextualizes the empirical analysis of this case. Understanding the variables driving cryptocurrency pricing in relation to NFT pricing patterns provides a foundation for future research concerning the relationship between these two asset classes which will only increase in significance as this economy develops. The sophistication of the platform's NFT marketplace, spatial dimension, exploratory rather than terminal use case, and VR compatibility distinguish Decentraland from metaverse ecosystems such as Axie Infinity and the Theta Network.

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[69] Dowling, Michael. "Fertile LAND: Pricing non-fungible tokens." *Finance Research Letters* 44 (2022): 102096.

[70] Dowling, Michael. "Is non-fungible token pricing driven by cryptocurrencies?." *Finance Research Letters* 44 (2022): 102097.

Methodology

      This paper builds several empirical models to assess the relationship between global

capital markets and three metaverse cryptocurrencies. A LASSO model is estimated for each of

the three cryptocurrencies of interest to this study: Decentraland, the Theta Network, and Axie

Infinity. The selection of the LASSO model for explaining the significance of global capital

markets variables to cryptocurrency asset prices has a foundation in existing literature.[71] The

goal of the models is to reveal which global capital markets variables are driving price

movements in these cryptocurrencies. As such, the LASSO method is best suited for this paper's

empirical analysis because it allows for the inclusion of many regressors. This is because the

LASSO regression employs regularization to avoid overfitting. The model's sparsity penalty

prevents overfitting by shrinking the coefficient vector toward the most significant explanatory

variables.[72] By identifying which global capital markets variables are most significant to the

prices of certain cryptocurrencies, implications can be drawn regarding what levers in the global

economy, if any, drive asset valuations in the metaverse.

      When looking at tokens with a fair number of investors for the purpose of analytical

interpretation, it is valuable to consider how different investors have different reasons for holding

these tokens and preempt this reality in the model. In other words, not all token investors are

made alike. For example, it is reasonable to assume that there are investors holding AXS as an

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[71] See Panagiotidis, Theodore, Thanasis Stengos, and Orestis Vravosinos. "A principal component-guided sparse regression approach for the determination of bitcoin returns." *Journal of Risk and Financial Management* 13, no. 2 (2020): 33. See also Tay, Jingyi K., Jerome Friedman, and Robert Tibshirani. "Principal component-guided sparse regression." *Canadian Journal of Statistics* 49, no. 4 (2021): 1222-1257. These studies employ a principal-component sparse regression, an extension of the LASSO model.
[72] For further explanation and origin of the LASSO method, see Tibshirani, Robert. "The lasso method for variable selection in the Cox model." *Statistics in medicine* 16, no. 4 (1997): 385-395.

appreciable asset while others hold AXS as a player of the game itself.[73] Given this condition, it

may prove difficult to disaggregate the value of these tokens based on the notion that different

token holders have different utility functions as it concerns the amortization of their investment.

As such, it is important to avoid treating investors in these tokens as a monolith, the significance

of which should be underlined as it concerns using the results of the empirical analysis to make

informed arguments surrounding the implications of observed relationships for international

political economy.

To preempt this issue, the paper assumes that the value of a blockchain ecosystem is

roughly represented by the market capitalization, and by extension price, of its cryptocurrency.[74]

For example, the in-game cryptocurrency for Decentraland is MANA. To transact in

Decentraland, which includes but is not limited to purchasing assets ranging from wearable items

to virtual real estate, requires buying MANA. However, anyone, even those with no intention of

transacting in Decentraland, can buy MANA just as they would buy bitcoin or any other

investment asset. As such, the market capitalization, and by extension the price, of MANA

reflects a market-based valuation of Decentraland. Because the price of a blockchain

ecosystem's cryptocurrency represents its market-based valuation, it is a useful response variable

when assessing the significance of global capital markets to the economies of these ecosystems.

Similarly, the global capital markets variables have been chosen to capture the diversified nature

of the global economy. These regressors include equity, debt, and foreign-exchange markets

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[73] Not to mention the fact that the Axie Infinity treasury wallet still holds a substantial share of AXS's market capitalization. See
https://etherscan.io/token/0xbb0e17ef65f82ab018d8edd776e8dd940327b28b#balances.
[74] See Appendix E for a brief discussion on the distinction between market capitalization for a cryptocurrency versus that of a company.

encompassing the global economy through the inclusion of variables with precedent in the existing literature on global capital markets versus cryptocurrency asset pricing models.[75]

In addition to global capital markets, the prices of bitcoin, AMC, and Microstrategy have been included as regressors in this study. Despite not being global capital markets variables, the point of including these in the model is to capture idiosyncratic fluctuations in the crypto market that might otherwise be credited to capital markets variables. By this logic, the LASSO models subject of this paper's empirical analysis will be less susceptible to under-inclusivity, a problem that arises in the LASSO regression as a trade off when it comes to the prevention of overfitting. The expectation is that a variable like bitcoin will be significant to each of the cryptocurrencies in this study precisely because the most capitalized cryptocurrencies have a central role in the price correlation network.[76] The same logic applies to AMC with regard to capturing market sentiment, another strong component of the price correlation network in which bitcoin plays only a marginal role.[77] Finally, the inclusion of Microstrategy (NASDAQ: MSTR),[78] to a certain extent, accounts for potential multicollinearity between bitcoin and global capital markets regressors in a way that does not obscure the goal of the model.[79] The inclusion of these non-

[75] See Appendix A for full list of regressors included in this study. For literature base, see Panagiotidis, Theodore, Thanasis Stengos, and Orestis Vravosinos. "A principal component-guided sparse regression approach for the determination of bitcoin returns." *Journal of Risk and Financial Management* 13, no. 2 (2020): 33.

[76] Aste, Tomaso. "Cryptocurrency market structure: connecting emotions and economics." Digital Finance 1, no. 1 (2019): 5-21.

[77] Ibid.

[78] A public company that holds a lot of bitcoin.

[79] Bitcoin may or may not correlate to equity markets, for example. See Adrian, Tobias, Iyer, Tara and Qureshi, Mahvash S. "Crypto Prices Move More in Sync With Stocks, Posing New Risks," *IMF*. January 11, 2022, https://blogs.imf.org/2022/01/11/crypto-prices-move-more-in-sync-with-stocks-posing-new-risks/ (Accessed April 20, 2022).

capital markets variables are intended to filter significance through the sieve of cryptocurrency market idiosyncrasies.

Data

      To achieve this end, daily data for the period spanning January 1st, 2021 to December 31st, 2021 (365 observations) were collected. 2021 was selected as the timeframe for this study due to 1) its recency, which implies that the market infrastructure is more sophisticated and efficient than if the study used, say, 2020 as the parameter, and 2) the fact that 2021 saw a market-changing explosion in metaverse and cryptocurrency asset values that have propelled what was once an obscure speculative sector to market relevancy. Restricting the timeframe to 2021 also avoids accounting for pandemic-related uncertainty in 2020 markets while waiting for the trading of these three cryptocurrencies to boast enough liquidity and order volume to constitute a functioning market, even if nascent.

      Price data for the cryptocurrencies are collected from CoinMarketCap, an authorized website which provides price data for cryptocurrencies fed from various exchanges.[80] The global capital markets data has been collected from Refinitiv Eikon, a set of software products for financial professionals to monitor and analyze financial information. For all variables, daily close price is selected as the metric of interest.[81] Although cryptocurrencies trade 24 hours of the day,

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[80] The price of any cryptoasset is a volume weighted average of market pair prices for the cryptoasset. The higher percentage of volume contributed from the pair, the more influence it has on the average price. The rationale for using a weighted average is because in general, markets with higher volume have higher liquidity and are less prone to price fluctuations. For more information, see Coin Market Cap, Metric Methodologies, https://support.coinmarketcap.com/hc/en-us/articles/360043395752-Price-Market-Pair-Cryptoasset- (Accessed April 3 2022).
[81] The reader is referred to Appendix A for a complete list of the independent variables considered.

many of the global capital markets variables do not trade on weekends and holidays. For days in which these markets do not trade, the mean for each standardized variable (0) is used instead. All of the data is standardized[82] for comparability of coefficients, so this choice facilitates in the negation of global capital markets variables' influence on cryptocurrency price movements on those days.

Limitations of available data constrict the study without suffocating its significance. One such limitation is the nascency of token markets. For example, the infrequency of tick-to-tick data available for Decentraland's MANA before it listed on Coinbase muddies the prospect of full standardization when it comes to the collection of close prices for the response variables. Additionally, CoinMarketCap, the source of metaverse cryptocurrency close prices in this study, only pulls volumes and rollup values rather than order book data, the latter of which would be ideal in a study like this. Finally, after hours trading in cryptocurrency implies imperfect timing as it concerns comparison between close prices of global capital markets variables and metaverse cryptocurrency prices. Nevertheless, the purpose of the empirical analysis to provide a launch point for academic discussion regarding how the initial indicators of metaverse cryptocurrency value, including what this analysis reveals about the stakeholders and derivatives of metaverse development, persists despite data limitations present in a maturing market.

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[82] Mean = 0, Standard Deviation = 1

Empirical Analysis

Axie Infinity ($AXS)

LASSO with Coefficients of Independent Variables

Variable	α = 0.009	Market Type	Geography
Bitcoin	0.487722	CRYPTO	N/A
U.S. Dollar/Philippine Peso FX Spot Rate	0.34483	FX	Asia
China Gov. Benchmark Bid Yield - 10 Years	-0.255678	DEBT	Asia
U.S. Dollar/Chinese Renminbi FX Spot Rate	-0.193581	FX	Asia
U.S. Government Benchmark Bid Yield - 10 Years	-0.166375	DEBT	United States
Philippine Stock Exchange Index	0.124699	EQUITY	Asia
AMC (NYSE: AMC)	0.1074	EQUITY	United States
Philippines Gov. Benchmark Bid Yield - 10 Years	0.095398	DEBT	Asia
Nikkei 225 Index	-0.058136	EQUITY	Asia
Microstrategy (NYSE: MSTR)	-0.050539	EQUITY	United States
CBOE SPX Volatility Index	0.032948	VOLATILITY	United States
EuroBond Benchmark Bid Yield – 10 Years	0.031277	DEBT	Europe
MSCI International Real Estate Index	-0.023088	EQUITY - SECTOR	N/A
BVSP Bovespa I Index	-0.016082	EQUITY	South America
S&P 500 Index	0	EQUITY	United States
Nasdaq 100 Index	0	EQUITY	United States
FTSE 100 Index	0	EQUITY	Europe
STOXX 600 Index	0	EQUITY	Europe
Shanghai Stock Exchange Index	0	EQUITY	Asia
Euro Stoxx 50 Volatility Index	0	VOLATILITY	Europe
CBOE China ETF Volatility Index	0	VOLATILITY	Asia
Euro/U.S. Dollar FX Spot Rate	0	FX	Europe
U.S. Dollar/Brazilian Real FX Spot Rate	0	FX	South America
FAANG Equity Index	0	EQUITY - SECTOR	N/A
R-Squared	*0.759294948*		

After bitcoin, the price of the Philippine Peso (PHP) relative to the U.S. Dollar emerges as the driving independent variable for AXS followed by Chinese Government Bonds and the price of the Chinese Yuan relative to the U.S. Dollar. The relation between the PHP and AXS is particularly interesting given the importance of the Philippines to Axie Infinity's daily active users. As such, the positive relationship between the PHP and the price of AXS will be at the core of the analytical implications following the regression results. The model at alpha = 0.009 was chosen as the evidential subject because at this point the error of the model is minimized while yielding a promising R-squared statistic of 75.9%.[83]

The results from the model suggest that the price of AXS is sensitive to the U.S. Dollar/Philippine Peso FX Spot Rate. The observed relationship between the U.S. Dollar/Philippine Peso FX Spot Rate and AXS is positive, indicating that a declining PHP relates to a rising AXS. This paper contends that this observation can be explained by the importance of the Philippines' economy to Axie Infinity's player-owned economy. If the weakening PHP is a result of uncertainty and weakened fundamentals in the Philippines' economy, a weaker PHP is related to a stronger AXS, and the majority of daily active users in Axie Infinity are in the Philippines, this presents strong evidence that the health of a *digital nation*'s economy is related to the health of the domestic economies from which its users would otherwise pursue economic opportunities. This is corroborated by the case of Dominic Lumabi chronicled by the *Japan Times*, a comprehensive survey of Axie Infinity players, and Samuel Popkin's *The Rational Peasant*, all to be discussed in further detail below.

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[83] See Appendix F for Alpha-Error Spectrum.

To understand the relationship between the PHP and AXS, it is first important to understand the macroeconomic context that has inspired the decline of the PHP in 2021. Continued uncertainty around the country's handling of COVID-19, the central bank's loose monetary policy stance, and weakening economic fundamentals are forces that have contributed to a weakening PHP.[84] As stated previously, the majority of Axie Infinity's daily active users are in the Philippines. If the PHP is important to AXS as the model suggests, and a significant share of Axie Infinity users are in the Philippines, a hypothesis associating the health of the domestic economy from which a substantial number of users on Axie Infinity would otherwise access income is warranted. This potential theoretical mechanism to explain the relationship between PHP and AXS is particularly persuasive because it does not rely on individuals who play the game actually holding PHP or converting PHP to and from in-game currency.[85] Rather, the connection being drawn derives from what a rising or declining PHP represents with regard to the state of the Philippines' economy and the alternative economic opportunities for players using Axie Infinity as a stream of income.

The Philippines' handling of COVID-19 and how that response has inspired economic uncertainty provides a link to connect PHP as an indicator of economic health to AXS. Consider the case of Dominic Lumabi, who found Axie Infinity as a way of earning income while laid off due to the pandemic. From playing just two hours daily, Lumabi neared the average income per month in his country,[86] and he is not alone. In July 2021, a 13-question survey of Axie Infinity

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[84] Mayvelin U. Carabello, "Peso seen declining vs U.S. dollar," 22 September 2021, https://www.manilatimes.net/2021/09/21/news/peso-expected-to-decline-vs-us-dollar/1815553 (Accessed 3 April 2022).

[85] Agence France-Press, "Life-changing' or scam? Axie Infinity helps Philippines' poor earn," *Japan Times*, February 16, 2022. https://www.japantimes.co.jp/news/2022/02/16/asia-pacific/axie-infinity-philippines-poor-earn/ (Accessed April 3, 2022).

[86] Ibid.

users was conducted by popular internet blog CoinGecko with 1,841 participants.[87] The survey emerged with several key findings that corroborate the theoretical mechanism provided above. According to the study, players earn an average of between 151 – 200 SLP ($55.50) per day, equivalent to $1,665 a month, and even if the price of the in-game currency drops 80%, the monthly earning is still higher than the minimum wage in the Philippines. This finding explains why most participants in the study (68%) think that the platform can potentially be a sustainable full-time job.

If the PHP declined due to economic uncertainty in the Philippines' economy, and the decline in the PHP relates to increased demand for AXS as reflected in its higher price, it may be the case that a player-owned economy such as Axie Infinity benefits from migration away from weak domestic economies from which its players might otherwise seek income. This explains why a platform like Axie Infinity has surged in popularity during the pandemic not only in the Philippines but also in economies particularly affected by pandemic-related economic turmoil such as Indonesia, Vietnam, Venezuela, and Brazil. This trend indicates that Axie Infinity as a stream of income is not only pandemic-resistant but pandemic-receptive. Lumabi is a case in point of this phenomenon in action. After losing his job due to the pandemic, he found an alternative source of income playing Axie Infinity. Even when reemployed, he found that his hourly wage from Axie Infinity exceeded his hourly wage as a content moderator and continued using the platform to supplement his earnings.

Samuel Popkin's *The Rational Peasant* provides further theoretical backbone to support this argument. In this book, Popkin reflects upon the moral, political, and economic conditions in

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[87] Erina Azmi, "CoinGecko Axie Infinity Survey 2021," *CoinGecko*, July 26 2021, https://www.coingecko.com/buzz/coingecko-axie-infinity-survey-2021 (Accessed April 3, 2022).

Vietnam that prompted the August Revolution.[88] His argument maintains relevance today as a

contextualization of behavior in Southeast Asian economies. Popkin argues that Vietnamese

villagers subject to his research are driven by rationality, self-interest, and maximization of

personal benefit more so than moral considerations such as tradition, rebutting the school of

thought that uses moral economy to explain behavior in this context. For Popkin, rationality is

understood as balancing short-term and long-term benefit to maximize self-interest. For example,

addressing short-term economic needs to prevent immediate fatal concerns such as starvation

must be balanced with the desire to achieve long-run economic health, lasting economic security,

and social mobility.

Popkin argues that these villagers are not only concerned with subsistence insurance, but

rather, are willing to take gambles to protect long-term security especially in the wake of

economic shock. This is relevant when framing the theoretical mechanism hypothesized to be

driving demand for AXS at the individual level. Although play-to-earn gaming is a gamble,

especially given the downside risk associated with the economy's long-term sustainability, it is a

rational gamble that individuals in an economy braced by economic shock, pandemic-driven and

otherwise, are willing to take. This explains the behavior of Lumabi who elects to continue

playing Axie Infinity despite returning to a traditional full-time job. Even though Axie Infinity

pays more per hour, earning money in this way is still a gamble compared to a full-time role that

covers immediate subsistence. Axie Infinity exists as an income stream, albeit a risky one, for

individuals in developing countries grappling with economic uncertainty. As such, this case

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[88] Popkin, Samuel. *The Rational Peasant*. *Theor Soc* 9, 411–471 (1980).
https://doi.org/10.1007/BF00158397.

provides newfound relevance to Popkin's theory of rationality and lends credibility to the claim that the Axie Infinity economy may persist even when individuals return to traditional roles.

The observed relationship between the price of the PHP and the price of AXS coupled with the evidence presented above frames Axie Infinity, and *digital nation* economies generally, as an asset class that benefits from pandemic-related demand for non-traditional sources of income. This is of great relevance to international political economy given that play-to-earn gaming in the context of a player-owned economy may persist as an emerging alternative to "real-world" occupations in developing economies susceptible to economic uncertainty, or at the very least, a risky side-hustle that will remain popular for individuals in economies prone to downside risk. Analysts expect the Philippine peso to drop even further against the U.S. dollar in 2022 as economic activities recover.[89] If this economy continues to struggle, the theoretical mechanism purported by this paper indicates that Axie Infinity's play-to-earn ecosystem is sustainable at least in the near-term. This is interesting to consider when evaluating the scale and duration of the current economic climate in the Philippines. If the domestic economy continues to struggle, and individuals who would otherwise be dependent on domestic economic opportunities find a source of income in Axie Infinity, labor force participation may suffer, creating a feedback loop that threatens the ability of the domestic economy to recover.

This implication is not limited to the Philippines. According to Sky Mavis, high proficiency in English, strong gaming culture, and widespread smartphone usage have fueled the

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[89] Mayvelin U. Carabello, "Analysts see further peso drop," *The Manila Times*, 2 January 2022, https://www.manilatimes.net/2022/01/02/news/analysts-see-further-peso-drop/1827941 (Accessed 3 April 2022).

platform's popularity in the Philippines.[90] This statement is corroborated by the CoinGecko

study which found that more than half (58%) of the participants play Axie Infinity on their

mobile devices compared to only 31% on desktop.[91] Countries neighboring the Philippines such

as Indonesia and Vietnam, areas in which Axie Infinity is already gaining traction, boast

similarly high smartphone penetration.[92] Perhaps the Philippines' labor force is a first mover in a

trend toward play-to-earn income as an alternative to declining income opportunities in

struggling domestic economies. Perhaps South Asia is at the epicenter of an economic

experiment characterized by large-scale migration away from stagnant domestic economies

toward accelerating opportunities in the virtual economy. Although speculative, these

implications are significant to consider in the context of international political economy, and by

extension, the future of the global economy.

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[90] Agence France-Presse, "Life-changing' or scam? Axie Infinity helps Philippines' poor earn," *Japan Times*, February 16, 2022. https://www.japantimes.co.jp/news/2022/02/16/asia-pacific/axie-infinity-philippines-poor-earn/ (Accessed April 3, 2022).

[91] Erina Azmi, "CoinGecko Axie Infinity Survey 2021," *CoinGecko*, July 26 2021, https://www.coingecko.com/buzz/coingecko-axie-infinity-survey-2021 (Accessed April 3, 2022).

[92] "Top Countries by Smartphone Users," https://newzoo.com/insights/rankings/top-countries-by-smartphone-penetration-and-users/ (Accessed 3 April 2022).

Theta Network ($THETA)
LASSO with Coefficients of Independent Variables

Variable	α = 0.001	α = 0.1	α = 0.5	Market Type	Geography
S&P 500 Index (U.S.)	0	0	0	EQUITY	N/A
Nasdaq 100 Index (U.S.)	0	0	0	EQUITY	Asia
FTSE 100 Index (Europe)	-0.151132	0	0	EQUITY	Asia
STOXX 600 Index (Europe)	0.176735	0	0	EQUITY	Asia
BVSP Bovespa I Index (South America)	0.024159	0.071363	0	EQUITY	United States
Shanghai Stock Exchange Index (Asia)	-0.166808	-0.138939	0	EQUITY	Asia
Philippine Stock Exchange Index (Asia)	-0.087764	-0.136521	0	EQUITY	United States
Nikkei 225 Index (Japan)	0.0374	0	0	EQUITY	Asia
CBOE SPX Volatility Index (U.S.)	0.009763	-0.084069	0	VOLATILITY	Asia
Euro Stoxx 50 Volatility Index (Europe)	0.05504	0	0	VOLATILITY	United States
CBOE China ETF Volatility Index (Asia)	-0.130216	0	0	VOLATILITY	United States
U.S. Dollar/Chinese Renminbi FX Spot Rate (Asia)	0.358111	0.024518	0	VOLATILITY	Europe
Euro/U.S. Dollar FX Spot Rate (Europe)	-0.036181	0	0	VOLATILITY	N/A
U.S. Dollar/Brazilian Real FX Spot Rate (South America)	-0.03019	0	0	VOLATILITY	S. America
U.S. Dollar/Philippines Peso FX Spot Rate (Asia)	-0.523048	-0.011641	0	VOLATILITY	United States
China Gov. Benchmark Bid Yield - 10 Years (Asia)	0.040471	0	0	DEBT	United States
U.S. Government Benchmark Bid Yield - 10 Years (U.S.)	0.454763	0.443141	0.109049	DEBT	Europe
Philippines Gov. Benchmark Bid Yield – 10 Years (Asia)	0	0	0	DEBT	Europe
EuroBond Benchmark Bid Yield – 10 Years	-0.146391	0	0	DEBT	Asia
FAANG Equity Index (Tech Sector)	-0.094596	0	0	EQUITY-SECTOR	Europe
MSCI International Real Estate Index (Real Estate Sector)	0.760605	0	0	EQUITY - SECTOR	Asia
Microstrategy (NYSE: MSTR)	-0.147149	0	0	EQUITY	Europe
Bitcoin	0.412486	0.165909	0	EQUITY	S. America
NYSE: AMC	0.031964	0	0	CRYPTO	N/A
R-Squared	*0.743446793*	*0.577304397*	*0.119214421*		

As shown in the table above, the coefficients on the independent variables in the Theta model evolve significantly over the alpha spectrum. At an alpha of 0.001, the international real estate sector index is the most significant factor for the price of the Theta token followed by the Philippine Peso. With an R-squared value of 74.3% and the lowest error for models across the alpha spectrum, it might, at first, make sense to consider this model as the primary informant to its implications for international political economy.

However, the shape of the alpha-error curve indicates that looking at models with higher alpha may be fruitful:
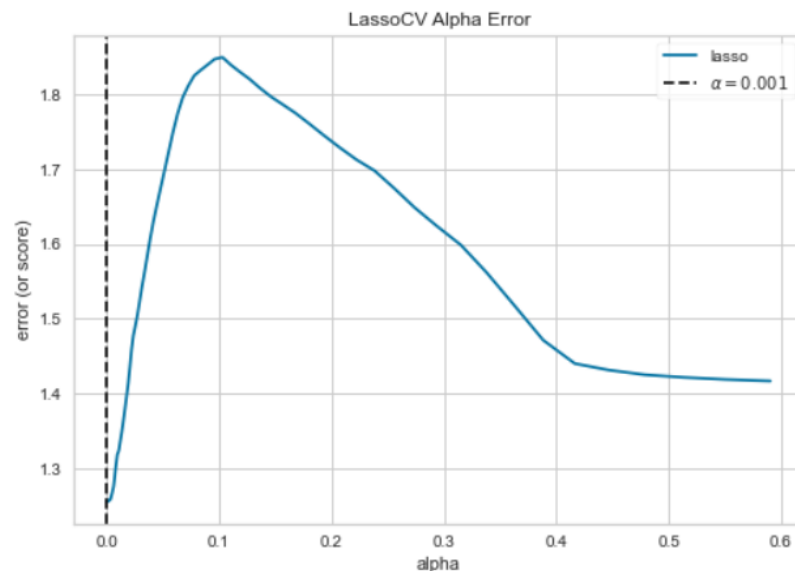
Although R-squared is conventionally the authoritative metric when it comes to assessing the success of a model's fit, regression results must be contextualized. Blindly going with the highest R-squared value, especially given the interpretive utility of how the LASSO regression shrinks coefficients toward zero, may not always yield the best model. Although the alpha of 0.001 yields a high R-squared value, the coefficients on the variables indicate that noise may be obscuring the true relationship between the regressors and the dependent variable. This is

because the model, at this alpha, exhibits symptoms of overfitting. Hints that allude to this observation include the large number of features in addition to the shape of the alpha-error curve which indicate that this may be a case where a biased model is showing an unrepresentatively high R-squared value.

Residual plots corroborate this hypothesis:

International Real Estate Index and Theta Token Price

Philippine Peso and Theta Token Price
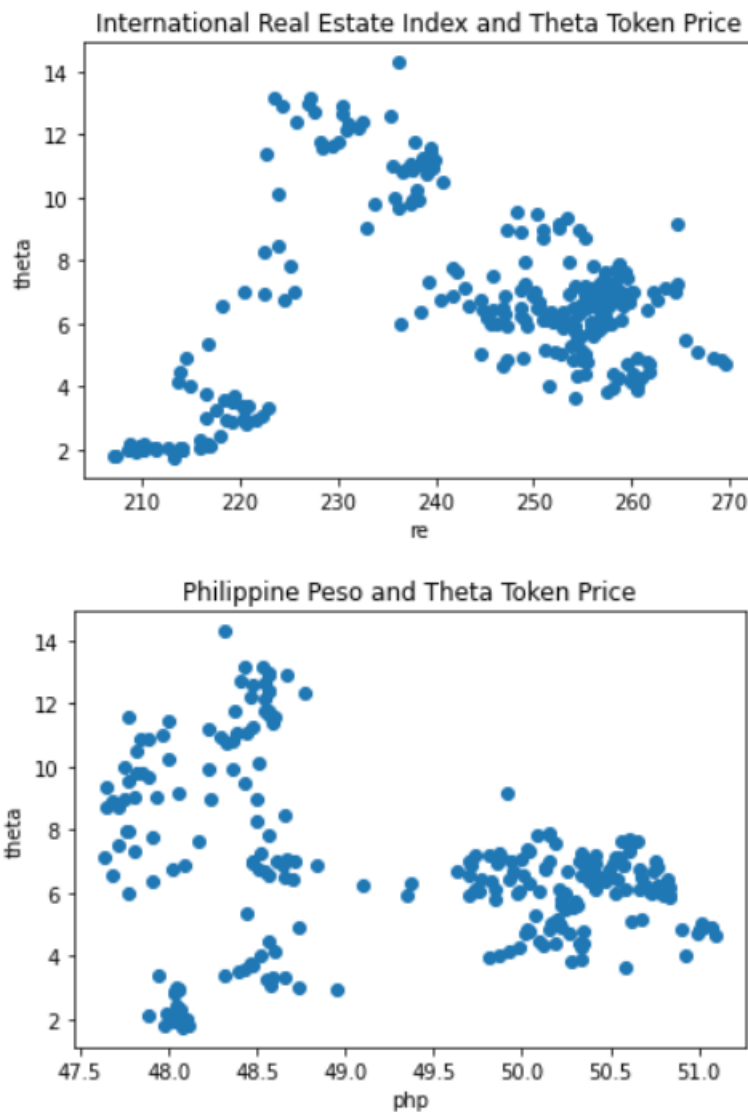
The residual plots of the two most significant variables to the model at an alpha of 0.001 indicate that the relationships being construed here are deceptive, as there is no clear relationship between either variable with the Theta token.

Looking once again at the shape of the alpha-error curve, at alpha greater than 0.1, error steadily decreases, and variables shrink to zero. Even though R-squared decreases as alpha increases across this spectrum, the fact that error decreases after 0.1 is a fact to consider when it comes to interpretation. This observation indicates that, in this particular case, analyzing coefficients as they exist in a greater than 0.1 alpha model may be fruitful.

The last variable to shrink to zero is the United States 10-Year Treasury Yield. As error decreases, all variables except for the U.S. Treasury Yield shrink to zero. The fact that error decreases while the relative significance of the U.S. Treasury Yield in the model increases cannot be ignored, especially given the residual plot between the two variables:

U.S. Government 10-Year Benchmark Bid Yield and Theta Network THETA Price
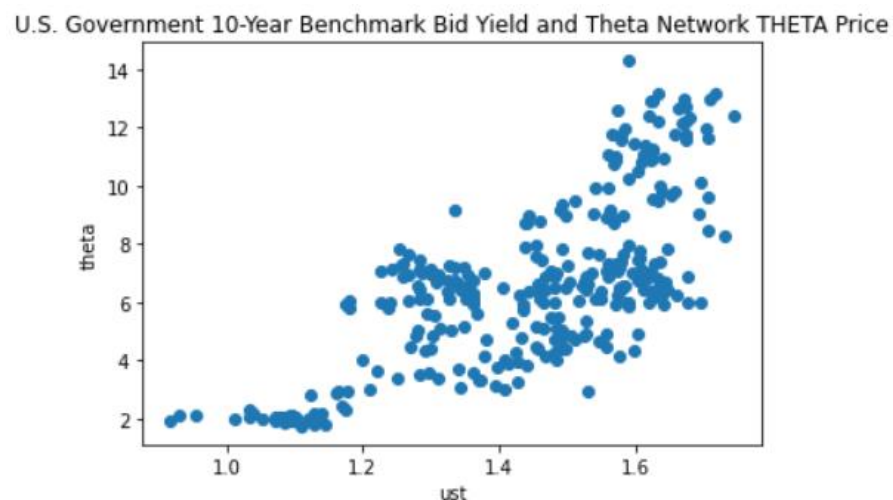
This residual plot depicts a much more persuasive correlational relationship between these two variables than the previous two plots. This indicates that shrinking the variables to zero

at higher alphas isolates United States Treasury Yields as being potentially significant to Theta, warranting analysis regarding a potential theoretical mechanism to explain this phenomenon.

A theoretical mechanism that explains the relationship between the U.S. Treasury Yield and Theta corroborates the conclusion of the regression analysis above. The U.S. Treasury Yield is positively related to the price of the Theta token. The premise of this analysis rests upon the theory that how a token behaves relative to global capital markets variables provides insight into what forces might be driving value in the asset. It is important to note that, especially in comparison to more nascent blockchain ecosystems, that the Theta trading market is healthy and relatively liquid with a deep enough order book to absorb multimillion-dollar changes in allocation. This reality is significant as it concerns speculating about theoretical mechanisms to explain the trends observed in the empirical analysis.

Following this logic, one might intuitively expect the Theta Network, a media and streaming platform, to behave with regard to global capital markets indicators like a company such as Netflix, Warner Brothers, or other media powers with significant market share in this space. However, if U.S. Treasury Yield is the most significant variable explaining Theta price as the regression model reasoning above indicates, this implies that Theta behaves unlike media company stocks which, theoretically, are negatively related to rising treasury yields.

In fact, the positive relation between Theta and the U.S. Treasury Yield indicates that the price of the Theta token behaves more like a conservative, inflation-hedge equity than it does a multimedia or streaming company. These businesses benefit, at least relative to the rest of the economy, from rising interest rates due to the assets that populate their balance sheets. There are several equities that may be useful for comparison here. However, the fact that the international real estate sector is so important to Theta at low alpha provides a hint as to where to start. Let us

consider a real estate investment trust, or REIT, which generally outperforms the broader

economy in higher-rate environments due to the underlying value of real estate as an alternative

asset in an inflationary environment. In a report, Standard & Poor's reviewed six periods since

the early 1970s during which the 10-year Treasury Yield increased substantially. REITs recorded

a positive total return in four of those periods and actually beat the market during half of them.[93]

Because REITs, by law, must distribute 90% of their taxable income as dividends, they do not

retain most of their free cash flow. This means that much of their capital is tied up, unable to be

used. The model indicates that something similar may be going on with Theta.

This paper purports that this is evidence to suggest that Theta tokens represent liability

linked inventory. The notion of liability linked inventory refers to a system in which holders of

the token are entitled to a certain service. In the REIT case above, the analog would be the

dividends granted to shareholders which must be at least 90% of the company's taxable income.

In Theta, this is token redemption. At any given time, a holder of the Theta token can "cash out"

by "redeeming" the token through conversion to another currency. This makes sense in the

context of Theta as a transient entity. A transient entity is characterized by how values are

represented in its database. [94] Because value in a transient entity's database acts more like a

placeholder than an actual storage of value, this means that a lot of the market capitalization of

Theta is locked up, much like a REIT in the case above.

This leads into the first implication for entities like Theta and its stakeholders: default

risk. Entities like REITs, airlines, and liability linked inventory companies generally are quite

susceptible to bankruptcy, a primary reason being that the business structure necessitates locked

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[93] For a depiction of REIT performance during sustained periods of rising interest rates, see Appendix G.
[94] Transient entity fields are fields that do not participate in persistence and their values are never stored in the database.

up capital flows due to entitlements. The results indicate that Theta is similar in that much of its value is locked up supply, making it liability linked inventory. The implication is that all it takes is a large-scale exodus from the Theta token to force the ecosystem into default. This exposes a weakness of an entity like Theta that may not be intuitive. Given the number of stakeholders in the Theta ecosystem, and the relevance of this platform and those like it to the future of the global economy, this is an important downside risk to consider.

There is a second implication to consider here following from the first. Theta as storage of value transient entity indicates that, at least given market activity in 2021, the value of the ecosystem as proxied by the price of the THETA token may point to speculation rather than value-add of the ecosystem in the status quo. The evidence suggesting this is that the value of the Theta ecosystem, proxied by the Theta token, represents a storage of value for investors more so than reflective compensation for network maintenance. This poses a potential problem for Theta and platforms like it in the future in that its contributors are being compensated with stores of value that are not only subject to default risk, but also tied to value so vulnerable to investor sentiment.

If the price of the Theta token is fueled at least in part by speculation as this reasoning suggests, this also means that the price of the reward the bandwidth contributor earns for providing the data exceeds the economic value the data yields. Not only does this point to the potential for a bubble, but it also means the price of data is inflated if you use Theta token compensation as a proxy for the value of underutilized data supporting its network. This is important to consider for economists, Theta's stakeholders, government regulators, and the global economy as it concerns interaction not only with Theta but also the platforms like it that are likely to continue emerging in the blockchain media and streaming space.

Decentraland ($MANA)
LASSO with Coefficients of Independent Variables

Variable	α = 0.001	α = 0.22	Market Type	Geography
S&P 500 Index (U.S.)	-0.308675	0	EQUITY	N/A
Nasdaq 100 Index (U.S.)	0.923214	0.201687	EQUITY	Asia
FTSE 100 Index (Europe)	0.032011	0	EQUITY	Asia
STOXX 600 Index (Europe)	0.084921	0	EQUITY	Asia
BVSP Bovespa I Index (South America)	0.069128	0	EQUITY	United States
Shanghai Stock Exchange Index (Asia)	-0.058676	0	EQUITY	Asia
Philippine Stock Exchange Index (Asia)	-0.08314	0	EQUITY	United States
Nikkei 225 Index (Japan)	-0.030043	-0.062763	EQUITY	Asia
CBOE SPX Volatility Index (U.S.)	0.088721	0	VOLATILITY	Asia
Euro Stoxx 50 Volatility Index (Europe)	0.127429	0.087995	VOLATILITY	United States
CBOE China ETF Volatility Index (Asia)	-0.083693	-0.021347	VOLATILITY	United States
U.S. Dollar/Chinese Renminbi FX Spot Rate (Asia)	-0.238707	-0.222188	VOLATILITY	Europe
Euro/U.S. Dollar FX Spot Rate (Europe)	-0.918813	-0.630462	VOLATILITY	N/A
U.S. Dollar/Brazilian Real FX Spot Rate (South America)	-0.087788	0	VOLATILITY	South America
U.S. Dollar/Philippines Peso FX Spot Rate (Asia)	-0.609055	-0.402569	VOLATILITY	United States
China Gov. Benchmark Bid Yield - 10 Years (Asia)	-0.079142	-0.094784	DEBT	United States
U.S. Government Benchmark Bid Yield - 10 Years (U.S.)	0.132706	0.02822	DEBT	Europe
Philippines Gov. Benchmark Bid Yield – 10 Years (Asia)	-0.091774	0	DEBT	Europe
EuroBond Benchmark Bid Yield – 10 Years	-0.092464	-0.042267	DEBT	Asia
FAANG Equity Index (Tech Sector)	-0.298462	0	EQUITY- SECTOR	Europe
MSCI International Real Estate Index (Real Estate Sector)	0.055345	0	EQUITY - SECTOR	Asia
Microstrategy (NYSE: MSTR)	-0.191429	-0.121034	EQUITY	Europe
Bitcoin	0.369044	0.341081	EQUITY	S. America
NYSE: AMC	-0.183354	-0.027741	CRYPTO	N/A
R-Squared	*0.694031186*	*0.65942838*		

The alpha-error curve indicates that the model's error is least at α = 0.022.[95] At this alpha,

shown in the results above, the model suggests that the Euro/U.S. Dollar FX Spot Rate is the

most significant variable for the price of Decentraland. Its coefficient is negative, which suggests

that a lower euro relative to the U.S. dollar predicts higher value for Decentraland. The residual

plot below illustrates the relationship:
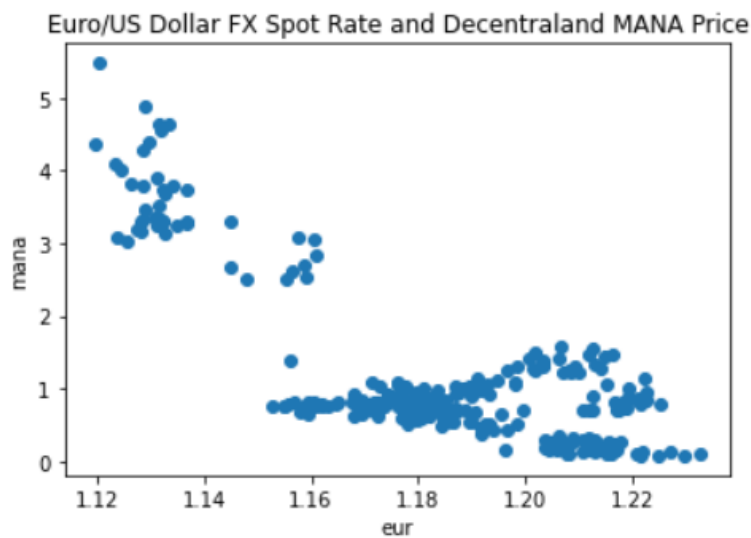
At first glance, the residual plot does not facilitate an outright rejection of a potential

relationship between these two variables. If this is true, two theoretical explanations potentially

corroborate the connection. Both interpretations derive from the calculation undergirding the

Euro Spot Rate. With the value of the euro in the numerator and the value of the dollar in the

denominator, either the euro's value is negatively driving the price of MANA, the dollar is

positively driving the price of MANA, or both.

Looking toward the other spot rates included in the model provides a clue as to where to

start. An interesting point to note from this comparison is that rising value for Asian currencies,

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[95] See Appendix F for Alpha-Error Spectrum.

specifically the Yuan and the Philippine Peso, relative to the U.S. dollar positively predicts the price of MANA whereas the rising value of the Euro relative to the U.S. dollar negatively predicts the price of MANA. This alludes to a hypothesis that Asian currency fundamentals are positive for the Decentraland economy while Western currency fundaments are negative for the Decentraland economy.

To evaluate the merit of this claim, and at its core the observed negative relationship between the Euro and the price of MANA, it is necessary to explore the underlying, or at least hypothesized, reasons behind the movements of both assets during 2021. This paper contends that the relationship between the Euro and MANA is largely coincidental as a result of coinciding events that significantly affected both assets in the fourth quarter of 2021. The decline in the Euro in 2021 is likely attributable to a variety of factors relating to the European Central Bank's monetary policy response to the COVID-19 pandemic. Throughout 2021, the ECB executed the Pandemic Emergency Purchase Programme (PEPP), a plan to buy 1.85 trillion euros worth of bonds, injecting a massive sum of Euros into the economy.[96] This coupled with the ECB's near zero benchmark interest rate which persisted throughout 2021 implies a very large circulating supply that shrank the value of the Euro relative to the dollar, which is particularly shocking given the expansive buyback program executed by the United States Federal Reserve during this same period.[97]

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[96] The ECB initially allocated €750 billion for PEPP asset purchases. This was increased by another €600 billion in June 2020 and again by €500 billion in December 2020, for a new total of €1.85 trillion. European Central Bank, "What is the pandemic emergency purchase programme (PEPP)?" July 28, 2021, https://www.ecb.europa.eu/ecb/educational/explainers/tell-me/html/pepp.en.html (Accessed April 20, 2022).

[97] "Federal Reserve officials are beginning to map out how and when they could shrink their $8.76 trillion portfolio of Treasury and mortgage securities, which more than doubled amid efforts to stabilize the economy over the past two years." Nick Timiraos, "Fed Weighs Proposals for Eventual Reduction in

On the other hand, the rapid increase in the price of MANA is likely attributable to the

announcement that Facebook would be changing its company name to Meta.[98] Given that the

value of the Euro decreased significantly over the course of 2021 due to monetary policy while

the value of MANA increased significantly with the Meta announcement, a decision likely

independent of ECB policy, the claim that the value of the Euro is causal to changes to the price

of Decentraland is unlikely. That being said, there is a compelling yet quirky tangential

explanation to explore here regarding the relationship between Decentraland and the concept of

digital fiat currencies. The context warranting this analysis is the progress of digital Euro

discussions in relation to the price of Decentraland. The European Commission is planning to

introduce a digital Euro bill in 2023, but little is known about the European Union's plans for

such a currency, including most significantly the unknown of whether or not the digital Euro

would run on a blockchain.[99] Depending on the timing of this announcement, it is possible that

this policy decision influenced the price of Decentraland. However, this is not a fair conclusion

based on the regression results of this paper given that economic policy change is outside the

scope of regressors tested which have been limited to global capital markets variables. A fruitful

extension of this paper's empirical analysis would involve codifying policy changes, specifically

Bond Holdings," *The Wall Street Journal*, 4 January 2022, https://www.wsj.com/articles/fed-weighs-proposals-for-eventual-reduction-in-bond-holdings-11641292201 (Accessed 3 April 2022).

[98] Ryan Browne, "A little-known cryptocurrency spiked 400% after Facebook changed its name to Meta," *CNBC*, 1 November 2021, https://www.cnbc.com/2021/11/01/decentraland-mana-cryptocurrency-rallies-after-facebook-name-change.html (Accessed 3 April 2022).

[99] Sandali Handagama, "The Digital Euro: What We Know So Far," *CoinDesk*, 11 February 2022, https://www.coindesk.com/policy/2022/02/11/the-digital-euro-what-we-know-so-far/ (Accessed 3 April 2022).

regarding the digitalization of existing fiat currencies, and the price of cryptocurrencies like MANA.[100]

There are two remaining explanations as to why the coefficient on the Euro is so high. The first is that the model is overfit. However, the residual plot above does not do enough to confirm this. The second explanation is that there exists a more complex relationship between global fiat currencies holistically and the price of MANA. Something interesting to note is that the value of the Chinese Yuan relative to the dollar is negative, along with the Philippine Peso, whereas the value of the Euro relative to the U.S. dollar is positive.[101] It is intriguing that the Yuan and the Euro exhibit opposite effects. Important to note here is the way in which the Yuan is pegged to the dollar.[102] The Yuan not being strictly determined by market-based factors might explain the divergence between the Euro and the Yuan in a vacuum. However, it does less to explain why the Philippine Peso behaves in a similar direction to the Yuan with regard to MANA without being pegged to the U.S. dollar.

A hypothesis that potentially ties these points together is the way in which the increased bifurcation between Eastern and Western spheres of influence, particularly manifested in economic interconnectedness, impacts the future of the economy. One might hypothesize that all fiat currencies should behave the same way against a cryptocurrency like MANA. However, the

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[100] A method for this has precedent in the literature. See Panagiotidis, Theodore, Thanasis Stengos, and Orestis Vravosinos. "A principal component-guided sparse regression approach for the determination of bitcoin returns." *Journal of Risk and Financial Management* 13, no. 2 (2020): 33.

[101] It may not appear that way at first glance because the coefficients on both are negative in the model. However, the euro variable is the Euro/USD spot rate whereas the others are USD/Chinese Yuan (PHP).

[102] China pegs the yuan to the U.S. dollar at a daily reference rate set by the People's Bank of China (PBOC) allowing the currency to fluctuate within a fixed band (set at 1% as of January 2014) on either side of the reference rate. Elvis Picardo, "Why China's Currency Tangos with the USD," *Investopedia*, 5 August 2019, https://www.investopedia.com/articles/forex/09/chinas-peg-to-the-dollar.asp#:~:text=China%20does%20not%20have%20a,a%20decade%20starting%20in%201994 (Accessed 3 April 2022).

model suggesting that one fiat currency positively predicts Decentraland price while another

negatively predicts that price is evidence in favor of the metaverse economy as an ecosystem

sensitive to global economic regimes especially in the near term. The goal of Decentraland, and

by method its cryptocurrency, is to create a virtual world that will act as a first mover in the

blockchain metaverse space. What the model indicates, specifically the diverging currency

effects, is that even a virtual world like Decentraland is not immune to central banks, global

supply chains, and relative fluctuations in fiat currencies. If the goal of Decentraland is to create

a virtual world and a cryptocurrency immune from the "physical" economy, the results of the

model indicate that, especially in its early stages, the metaverse will still be very much subject to

the whims of governments, regulations, and global economic forces as represented in this

analysis by foreign exchange spot rates.

Alternatively, to take a more American-centric approach, it could be the case that

investment in Decentraland is most attractive when the value of the dollar does not reciprocate

rising American equity prices, signaling that the "dollar to zero" effect positively impacts the

Decentraland economy. A data point to corroborate this argument would be the coefficient on the

NASDAQ 100 across the alpha spectrum. A strong U.S. economy (equities going up) with non-

reciprocal response from the dollar (U.S. dollar continues going down despite equities going up)

may be motivating, or at least sustaining, Decentraland's rapid price increase. This is yet another

corroboration of the theory that central banks, in determining the amount of fiat currency in

circulation, are intimately connected to metaverse cryptocurrencies like MANA. This

underscores an interesting irony revealed by the model and corroborated by the other models

explored in this paper: the idea that central banks are significant to price fluctuations of

cryptocurrencies whose advantage it is to purport relative independence from financial

intermediaries and shield against long-term risks associated with fiat currencies.

Conclusion

This paper argues that global capital markets are significant predictors of cryptocurrency asset prices in the primordial metaverse economy, loosely defined as cryptographic economic activity occurring in relatively unregulated blockchain ecosystems. This is significant because it implies that opportunities to earn income in the metaverse are tied to traditional macroeconomic levers despite aesthetic separation from the traditional, and regulated, global economy. This is crucially important to the theorization of *digital labor*, the growing class of individuals turning to the metaverse as a means of attaining financial security when their local economy cannot meet that demand. As such, this is a starting point for the novel study of what this paper coins as *metaverse political economy*. The goal of this essay is to awaken mainstream international political economy scholars and inspire future scholars of international relations to study the ways in which economic opportunities in the metaverse are affected by the global economy and vice versa. The future of the global economy, specifically the expectation that automation will continue to supplant traditional jobs amid stagnant emerging market economies racked by hyperinflation, should propel metaverse political economy as a subfield of international political economy to mainstream relevance as time passes.

Each of the empirical models indicate that global capital markets variables significantly relate to cryptocurrency prices of blockchain ecosystems. The paper contends that U.S. Dollar/Philippines Peso FX Spot Rate is positively related the price of Axie Infinity, which implies that a country with a struggling fiat currency may see its labor force migrate to economic opportunities in the metaverse. There is evidence to suggest that the U.S. Government 10-year Benchmark Bid Yield is positively related to the price of the Theta Network, which implies that its cryptocurrency constitutes liability linked inventory alluding to conception amortization risks.

Finally, several fiat currencies are important to Decentraland, which implies that not even virtual worlds are immune from the monetary policy positions of central banks.

Sensitivity of the metaverse economy to the global economy is important to international political economy with regard to the future of work. Experts project that 50% of work will be automated by 2050.[103] Even if that projection is ambitious, struggling economies spurred by the COVID-19 pandemic may lead the labor force to look for greener pastures which some already see in the metaverse economy. However, global capital markets being important to the metaverse economy implies that it is not, at least at this time, immune to macroeconomic forces. Despite new modes of earning, opportunity, and communication enabled by blockchain technology, practicable in the metaverse, and theoretically separate from traditional finance, these new forms of work come with their own brand of risk tied to the broader global economy. This implies that metaverse work, at least in the status quo, may not be the long-term fix to the automation of jobs or a stagnating economy.

Metaverse Political Economy: Taking the Bite

Where do we go from here? Given the relevance of the metaverse to the future of the global economy, and positing that the nascency of the metaverse enterprise implies uncertainty with regard to the ultimate benefit or deficit to global society, what is the appropriate reaction to its development? Although much of the discussion thus far has focused on the economic interplay between the metaverse and global capital markets, this question is fundamentally

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[103] Posner, Eric A. and Weyl, E. Glen. *Radical Markets: Uprooting Capitalism and Democracy for a Just Society*. Princeton: Princeton University Press. 2018. p. 222.

political. Regulation, for example, is one of many powerful and perhaps inevitable instruments in play for powerful actors to constrain or embolden the metaverse as the dust settles. What then is the role of individuals and institutions endowed with the political, social, and/or legal clout to significantly influence the trajectory of metaverse economic development?

The answer may be unsatisfying, especially to those for whom political and economic questions boil down to a science, a cost-benefit analysis from which the answer is delivered on a silver platter of formulas and carefully curated chains of peer-reviewed literature. How do you conceptualize global governance or justify market intervention in a societal mode that does not yet exist? To inform this meditation, consider metaphysician L.A. Paul's seductive thought experiment:

> *"You have a one-time-only chance to become a modern-day vampire. You think, 'This is a pretty amazing opportunity, do I want to gain immortality, amazing speed, strength, and power? But do I want to become undead, become an immortal monster and have to drink blood? It's a tough call.'"[104]*

A tough call indeed: immortal power in one hand, impermanent bliss in the other. What does Paul think?

> *"You can't, as a mere human, understand what it's like to become a vampire just by hearing me talk about it. Until you're a vampire, you're just not going to know what it's going to be like…how could you possibly make a rational decision about whether or not*

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[104] Both excerpts draw on a speech given at HeadCon in 2014 which is partially transcribed at https://www.edge.org/conversation/la_paul-la-paul-the-transformative-experience (Accessed April 20, 2022). For the original text, see Paul's book: Paul, Laurie Ann, *The Transformative Experience*, Oxford: Oxford University Press, 2014.

to become a vampire? You don't know, and you can't know what it's like. You can't know what you'd be choosing to do if you became a vampire, and you can't know what you're missing if you pass it up."

This is perhaps the best frame from which to think about the metaverse bargain from a political perspective in its nascency. On one hand, the metaverse as an information technology apparatus has the potential to inspire the next great wave of globalization, democratizing access to opportunities, spaces, and markets not simply by lowering the barrier to entry from an ocean to a broadband connection but even more significantly through a new imagination of ownership enabled by blockchain technology and irrigated through its ecosystems. On the other hand, the metaverse may propel society to a Matrix-esque world of unrecognizability and impersonality, not to mention more practical concerns of deepening heterogeneity and inequality within and between countries, cultures, and groups. To apply Paul's logic to this contention, making a rational decision in the status quo may be impossible. Who are we to litigate a future society we cannot yet understand or recognize? All we can do is promote development of the technology, strive for democratized access to its benefits, discover informative relationships through academic exploration, and allow these markets to build themselves.

To rationalize as the vampire, you must first be bitten.

Appendix A: What is the Metaverse?

Although the term "metaverse" debuted in 1992,[105] definitions of the metaverse, particularly imaginations of its ultimate societal integration, vary. However, this paper generally accepts the following framework:

> "The term 'metaverse' has been coined to further facilitate the digital transformation in every aspect of our physical lives. At the core of the metaverse stands the vision of an immersive Internet as a gigantic, unified, persistent, and shared realm."[106]

It may be useful to think about the metaverse as a more immersive analog to social media. In the same way that the term social media comprises many platforms in which users communicate, construct identities, interact, and collaborate, the term metaverse comprises the many platforms in which users perform these same functions in the next era of societal digitization.

The way in which the metaverse penetrates society is largely dependent on the trajectory of the technological developments that facilitate its adoption. For example, ubiquitous wireless connections coupled with powerful edge computing technologies may allow virtual reality (VR) users to fully immerse themselves in virtual worlds using head-mounted rendering displays. However, this paper does not qualify metaverse interaction with VR capabilities. Learning from the status quo of metaverse development requires an exploration of its primordial form. As such, this paper explores the metaverse economy as manifested through the blockchain ecosystems actively facilitating the digital transformation of economic opportunity.

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[105] Stephenson, Neal. *Snow Crash*. New York: Bantam Books, 1992.
[106] Lee, Lik-Hang, Tristan Braud, Pengyuan Zhou, Lin Wang, Dianlei Xu, Zijun Lin, Abhishek Kumar, Carlos Bermejo, and Pan Hui. "All one needs to know about metaverse: A complete survey on technological singularity, virtual ecosystem, and research agenda." arXiv preprint arXiv:2110.05352 (2021).

Appendix B: What is Blockchain?

A blockchain is a secure and decentralized database in which nodes interact in a common, consistent, dynamically updated network. A blockchain ecosystem is composed of data to be stored, transmitted, and synchronized between nodes in order to achieve a uniform experience for the platform's users. Blockchain is an integral part of the metaverse because its technology enables users to protect their digital assets in virtual reality.[107] A blockchain is built upon smart contracts, a technological innovation that employs digital cryptography to verify agreements made between two nodes, or users, of a system. Instead of verification by means a centralized governor endowed by popular authority to enforce contracts, blockchain technology automatically enforces smart contracts written into its digital ledger without the need for third-party intervention.

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[107] Anonymous, "Decentralized Economy – the Role of Blockchain in the Metaverse," *PixelPlex*, 9 February 2022. https://pixelplex.io/blog/importance-of-blockchain-in-metaverse/ (Accessed April 3, 2022).

Appendix C: Global Capital Markets Regressors

S&P 500 Index (U.S.)
Nasdaq 100 Index (U.S.)
FTSE 100 Index (Europe)
STOXX 600 Index (Europe)
BVSP Bovespa I Index (South America)
Shanghai Stock Exchange Index (Asia)
Philippine Stock Exchange Index (Asia)
Nikkei 225 Index (Japan)
FAANG Equity Index (Tech Sector)
MSCI International Real Estate Index (Real Estate Sector)
CBOE SPX Volatility Index (U.S.)
Euro Stoxx 50 Volatility Index (Europe)
CBOE China ETF Volatility Index (Asia)
U.S. Dollar/Chinese Renminbi FX Spot Rate (Asia)
Euro/U.S. Dollar FX Spot Rate (Europe)
U.S. Dollar/Brazilian Real FX Spot Rate (South America)
U.S. Dollar/Philippines Peso FX Spot Rate (Asia)
China Gov. Benchmark Bid Yield - 10 Years (Asia)
U.S. Government Benchmark Bid Yield - 10 Years (U.S.)
Philippines Gov. Benchmark Bid Yield – 10 Years (Asia)
Switzerland 10 Year Benchmark
Euro 10 year benchmark
Microstrategy
BTC
AMC

Appendix D: Blockchain Ecosystem Comparison Table

(as of December 31, 2021)[108]

	Price	Market Capitalization	Volume (24 hrs)	Comparable to
Decentraland ($MANA)	$3.27	$5,967,477,220	$561,240,411	The Sandbox ($SAND)
Theta Network ($THETA)	$4.71	$4,714,737,796	$163,528,393	Render Token ($RNDR)
Axie Infinity ($AXS)	$93.30	$5,682,453,146	$193,157,441	Illuvium ($ILV)

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[108] Per CoinMarketCap. https://coinmarketcap.com/.

Appendix E: Market Capitalization for a Cryptocurrency versus a Company

Market capitalization for a cryptocurrency versus a company is different, and this distinction is valuable as it concerns extrapolating implications from the empirical analysis of this study. For a company, market capitalization refers to the total value of a company's shares stock. Stock market capitalization for a company is calculated by multiplying shares outstanding by share price. Crypto token market capitalization is calculated by multiplying the price of a cryptocurrency token with the number of tokens in circulation. The latter half of this multiplication is significant as it concerns the difference between market capitalization for a company and a crypto token. This is because tokens in circulation is distinctly different from shares outstanding in the context of describing an enterprise. Just because a token is in circulation does not necessarily mean it is accessible to the public market.

Consider that out of Axie Infinity's total supply of 270 million tokens, approximately 80% of tokens are held by a "central bank" of sorts which intermittently injects more tokens into the public supply. This has prompted the Philippines government to consider classifying Axie Infinity as a company that runs payment systems, opening the parent company Sky Mavis to a minefield of regulations if the Philippines government were to execute on this, highlighting yet again the relevance of metaverse cryptocurrency to the study of international relations. This is not even to mention the issue of lost supply in cryptocurrencies.[109] Although outside the scope of this paper's analysis, the issues of lost supply and crypto central banks are ripe arenas for international relations scholarship to explore in further analyses.

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[109] In the case of bitcoin, forensics company Chainalysis estimates that roughly 20% of the maximum supply of 21 million have been lost due to there being no way to access holdings from addresses without a private key. See Chainanalysis Team, June 18, 2020, "https://blog.chainalysis.com/reports/bitcoin-market-data-exchanges-trading/" (Accessed April 20, 2022).

Appendix F: Alpha-Error Curves[110]
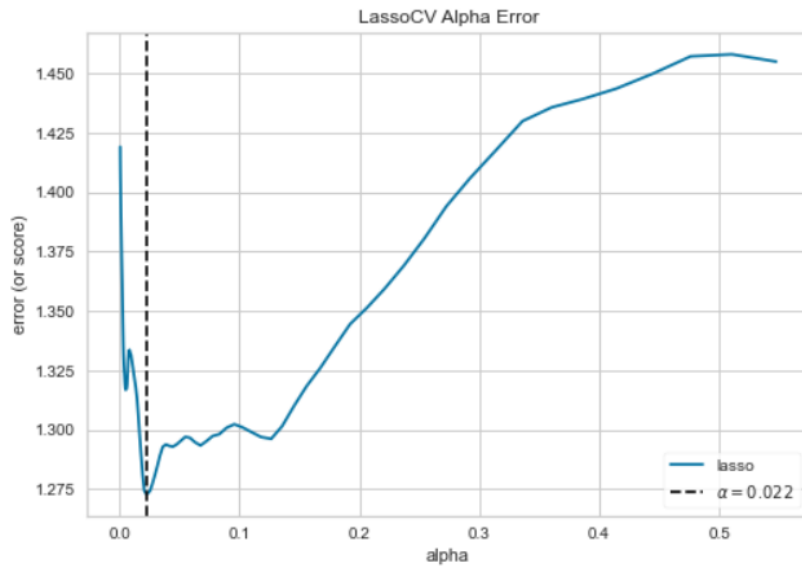
Axie Infinity ($AXS)
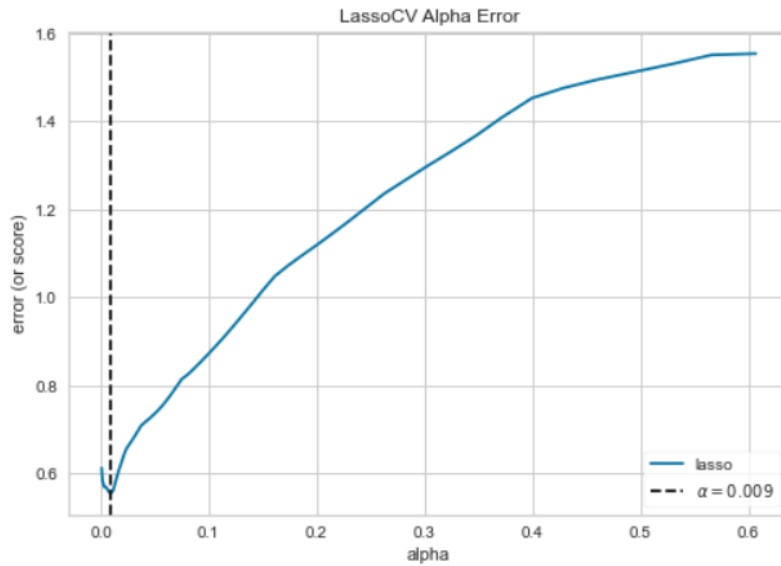
Theta Network ($THETA)

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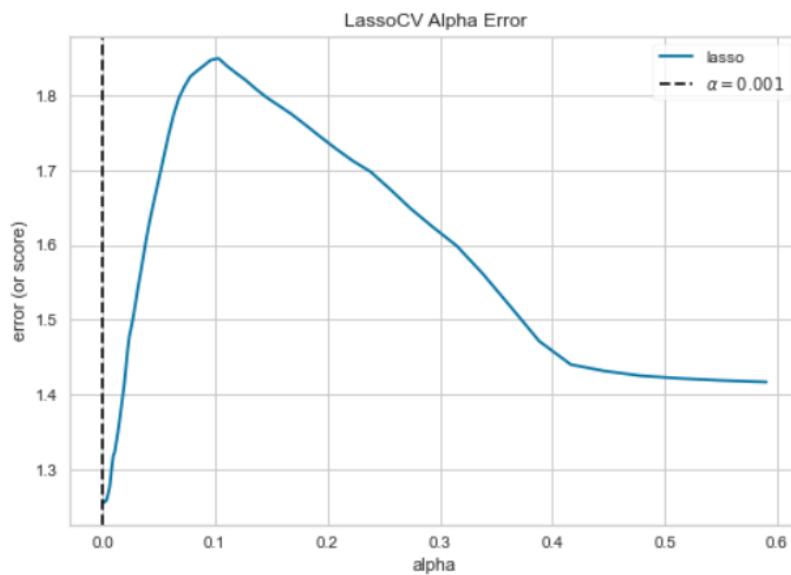
[110] These visualizations depict how the models respond to regularization. Cross-validation is built into each of the regression models.

Decentraland ($MANA)

LassoCV Alpha Error

Appendix G: REIT Performance During Sustained Periods of Rising Interest Rates

| TIME PERIOD | U.S. 10-YEAR TREASURY YIELD | | | CUMULATIVE TOTAL RETURN OVER PERIOD | | |
	BEGINNING YIELD (%)	ENDING YIELD (%)	CHANGE (%)	REITS (%)	STOCKS (%)	DIFFERENCE (%)
December 1976-September 1981	6.9	15.3	8.5	137.4	46.0	91.4
January 1983-June 1984	10.5	13.6	3.1	35.6	16.5	19.1
August 1986-October 1987	7.2	9.5	2.4	-10.1	10.9	-21.0
October 1993-November 1994	5.3	8.0	2.6	-10.3	0.1	-10.3
October 1998-January 2001	4.5	6.7	2.1	27.4	27.8	-0.4
June 2003-June 2006	3.3	5.1	1.8	108.2	37.6	70.6

Source: S&P Dow Jones Indices LLC, Bloomberg, The Federal Reserve

Bibliography

Adrian, Tobias, Iyer, Tara and Qureshi, Mahvash S. "Crypto Prices Move More in Sync With

　　　Stocks, Posing New Risks," *IMF*. January 11, 2022,

　　　https://blogs.imf.org/2022/01/11/crypto-prices-move-more-in-sync-with-stocks-posing-

　　　new-risks/ (Accessed April 20, 2022).

Agence France-Press. "Life-changing' or scam? Axie Infinity helps Philippines' poor earn."

　　　Japan Times. February 16, 2022. https://www.japantimes.co.jp/news/2022/02/16/asia-

　　　pacific/axie-infinity-philippines-poor-earn/ (Accessed April 3, 2022).

Alcántara, Ann-Marie. "Marketers Explore Metaverse Worlds." *The Wall Street Journal*. March

　　　2 2022. https://www.wsj.com/articles/marketers-explore-metaverse-worlds-11646218800

　　　(Accessed April 3 2022).

Anonymous, "Decentralized Economy – the Role of Blockchain in the Metaverse," *PixelPlex*, 9

　　　February 2022. https://pixelplex.io/blog/importance-of-blockchain-in-metaverse/

　　　(Accessed April 3, 2022).

Anshechung.com. Anshe Chung Becomes First Virtual World Millionaire. February 18, 2007.

　　　http://www.anshechung.com/include/press/press_release251106.html (Accessed 3 April

　　　2022).

Azmi, Erina. "CoinGecko Axie Infinity Survey 2021." *CoinGecko*, July 26 2021.

https://www.coingecko.com/buzz/coingecko-axie-infinity-survey-2021 (Accessed April 3, 2022).

Baeriswyl, Jan. "Understanding P2E 2.0: Axie Infinity Deep Dive." *Outlier Ventures*, July 2021. https://outlierventures.io/research/understanding-p2e-2-0-axie-infinity-deep-dive/#:~:text=Whereas%20SLP%20has%20an%20unlimited%20supply%2C%20AXS%20is,which%20is%20subsequently%20added%20to%20the%20community%20treasury (Accessed April 3, 2022).

Baldwin, Richard. The Great Convergence: Information Technology and the New Globalization. Cambridge, MA: Harvard University Press, 2016.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott. "The empirics of firm heterogeneity and international trade." Annu. Rev. Econ. 4, no. 1 (2012): 283-313.

Bourlakis, Michael, Savvas Papagiannidis, and Helen Fox. "E-consumer behaviour: Past, present and future trajectories of an evolving retail revolution." *International Journal of E-Business Research (IJEBR)* 4, no. 3 (2008): 64-76.

Brand Essence Research. "Metaverse Market Size, Share, Companies & Trends Analysis Report By Component (Hardware {Display, EXtended Reality (XR)Hardware, AR/VR Headsets}, Software {Asset Creation Tools, Programming Engines}), By Type (Desktop,

Mobile), By Offerings (Virtual Platforms, Avatars, Asset Marketplaces, Financial

Services), By Technology (Blockchain, Virtual Reality (AR) & Augmented Reality (AR),

Mixed Reality (MR)), By Application (Online Shopping, Gaming, Social Media, Content

Creation, Conferences, Others), By End-User (Education, Fashion, Media &

Entertainment, Aerospace & Defense, Other) Metaverse Industry Based On Region, And

Segment Forecasts, 2021 – 2027." January 2022.

https://brandessenceresearch.com/technology-and-media/metaverse-market-size

(Accessed April 3, 2022)

Browne, Ryan. "A little-known cryptocurrency spiked 400% after Facebook changed its name to

Meta." *CNBC*. November 1, 2021, https://www.cnbc.com/2021/11/01/decentraland-

mana-cryptocurrency-rallies-after-facebook-name-change.html (Accessed April 3, 2022).

Cairncross, Frances. The Death of Distance. Cambridge: Harvard Business School Press. 1997.

Carabello, Mayvelin U. "Analysts see further peso drop," *The Manila Times*, January 2, 2022,

https://www.manilatimes.net/2022/01/02/news/analysts-see-further-peso-drop/1827941

(Accessed April 3, 2022).

Carabello, Mayvelin U. "Peso seen declining vs U.S. dollar," September 22, 2021,

https://www.manilatimes.net/2021/09/21/news/peso-expected-to-decline-vs-us-

dollar/1815553 (Accessed 3 April 2022).

Cooper, James. "Towards the Metaverse: First thing we do, let's grill all the lawyers." January

    21, 2022. https://thehill.com/opinion/technology/590319-towards-the-metaverse-first-

    thing-we-do-lets-grill-all-the-lawyers (Accessed April 3, 2022).

Chainanalysis Team, June 18, 2020, "https://blog.chainalysis.com/reports/bitcoin-market-data-

    exchanges-trading/" (Accessed April 20, 2022).

Cuthbertson, Anthony. "Virtual land within metaverse sells for record $2.43 million." November

    29, 2021. https://finance.yahoo.com/news/virtual-land-within-metaverse-sells-

    125953699.html#:~:text=A%20500%2Dsquare%2Dmetre%20plot,within%20a%20virtua

    l%20reality%20world (Accessed 3 April 2022).

Der Derian, James. *Virtuous war: Mapping the military-industrial-media-entertainment-network*.

    Routledge, 2009.

DeSanctis, Gerardine, and Marshall Scott Poole. "Capturing the complexity in advanced

    technology use: Adaptive structuration theory." Organization science 5, no. 2 (1994):

    121-147.

Dowling, Michael. "Fertile LAND: Pricing non-fungible tokens." *Finance Research Letters* 44

    (2022): 102096.

Dowling, Michael. "Is non-fungible token pricing driven by cryptocurrencies?." *Finance*

Research Letters 44 (2022): 102097.

Dundas, Katie. "What is the Metaverse." *TechRadar*. November 23, 2021.

https://www.msn.com/en-us/news/technology/what-is-the-metaverse/ar-AAQXdKh

(Accessed April 3, 2022).

European Central Bank, "What is the pandemic emergency purchase programme (PEPP)?" July

28, 2021, https://www.ecb.europa.eu/ecb/educational/explainers/tell-

me/html/pepp.en.html (Accessed April 20, 2022).

Freyman, Neal [Personal Interview]. *Matt Levine's MoneyStuff*. December 20, 2021.

Handagama, Sandali. "The Digital Euro: What We Know So Far." *CoinDesk*. February 11, 2022.

https://www.coindesk.com/policy/2022/02/11/the-digital-euro-what-we-know-so-far/

(Accessed April 3, 2022).

Hardy, Jonathan. *Critical political economy of the media: An introduction*. Routledge, 2014.

Harris, Kim, Richard Harris, and Steve Baron. "Customer participation in retail service: lessons

from Brecht." International journal of retail & distribution management (2001).

Hayward, Andrew. "Mark Cuban Joins Ethereum NFT Game Axie Infinity's $7.5 Million

Raise." *Decrypt*. 11 May 2021. https://decrypt.co/70554/ethereum-nft-game-axie-infinity-mark-cuban-alexis-ohanian (Accessed April 3, 2022).

Herrman, John and Browning, Kellen. "Are We in the Metaverse Yet." 29 October 2021. https://www.nytimes.com/2021/07/10/style/metaverse-virtual-worlds.html (Accessed April 3, 2022).

Higgins, Stan, "$26 Million: Blockchain VR Project Decentraland Raises New Funding in ICO," *CoinDesk*, August 18, 2017, https://www.coindesk.com/markets/2017/08/18/26-million-blockchain-vr-project-decentraland-raises-new-funding-in-ico/ (Accessed April 20, 2022).

Knight, R. "Metaverse Economy Could Value up to $30 Trillion Within Next Decade." November 2021. https://beincrypto.com/metaverse-economy-could-value-30-trillion-ina-decade/ (Accessed April 3, 2022).

Knowles, Tom, "Facebook's libra cryptocurrency project ends in failure," *The Times*, January 28, 2022, https://www.thetimes.co.uk/article/facebooks-libra-cryptocurrency-project-ends-in-failure-cxvnnc3kx#:~:text=It%20was%20once%20promoted%20as,project%20has%20ended%20in%20failure. (Accessed April 20, 2022).

Ledesma, Lyllah. "Axie Infinity Finds Ready Players in Hyperinflation-Racked Venezuela,"

CoinDesk, 23 November 2021, https://www.coindesk.com/markets/2021/11/23/axie-infinity-finds-ready-players-in-hyperinflation-racked-venezuela/ (Accessed April 3, 2022).

Ledezma, Ivan. "Product-market integration with endogenous firm heterogeneity." Oxford Economic Papers 73, no. 3 (2021): 1345-1368.

Lee, In. "What is E-business? How the Internet Transforms Organizations." International Journal of E-Business Research 3, no. 2 (2007): 83-85.

Lee, Lik-Hang, Tristan Braud, Pengyuan Zhou, Lin Wang, Dianlei Xu, Zijun Lin, Abhishek Kumar, Carlos Bermejo, and Pan Hui. "All one needs to know about metaverse: A complete survey on technological singularity, virtual ecosystem, and research agenda." arXiv preprint arXiv:2110.05352 (2021).

Leeds, Roger. *Private Equity Investing in Emerging Markets*. "Comparing Private Equity Ecosystems." 2003.

Liu, Jing, and Zhentian Liu. "A survey on security verification of blockchain smart contracts." *IEEE Access* 7 (2019): 77894-77904.

Lotz, Amanda D., and Horace Newcomb. "The production of entertainment media." In *A Handbook of Media and Communication research*, pp. 75-92. Routledge, 2020.

Muth, Karl T. and Leventhal, Andrew, "Mutuals: An Area of Legal Climate Change," William and Mary Business Law Review volume 9, number 597, 2018).

"Mutual Company" in JOHN DOWNES & JORDAN GOODMAN, DICTIONARY OF FINANCE AND INVESTMENT TERMS (Barrons 2014).

Official Axie Infinity Whitepaper. Last updated November 2021. https://whitepaper.axieinfinity.com/ (Accessed April 3, 2022).

Panagiotidis, Theodore, Thanasis Stengos, and Orestis Vravosinos. "A principal component-guided sparse regression approach for the determination of bitcoin returns." *Journal of Risk and Financial Management* 13, no. 2 (2020): 33.

Papagiannidis, Savvas, Michael Bourlakis, and Feng Li. "Making real money in virtual worlds: MMORPGs and emerging business opportunities, challenges and ethical implications in metaverses." *Technological Forecasting and Social Change* 75, no. 5 (2008): 610-622.

Paul, Laurie Ann, *The Transformative Experience*, Oxford: Oxford University Press, 2014.

Picardo, Elvis. "Why China's Currency Tangos with the USD." *Investopedia*. August 5, 2019.

https://www.investopedia.com/articles/forex/09/chinas-peg-to-the-dollar.asp#:~:text=China%20does%20not%20have%20a,a%20decade%20starting%20in%201994 (Accessed April 3, 2022).

Popkin, Samuel. *The Rational Peasant*. *Theor Soc* 9, 411–471 (1980). https://doi.org/10.1007/BF00158397.

Posner, Eric A. and Weyl, E. Glen. *Radical Markets: Uprooting Capitalism and Democracy for a Just Society*. Princeton: Princeton University Press. 2018. p. 222-249.

Shevlin, Ron. "Digital Land Grab: Metaverse Real Estate Prices Rose 700% In 2021." *Forbes*. February 4, 2022. https://www.forbes.com/sites/ronshevlin/2022/02/04/digital-land-grab-metaverse-real-estate-prices-rose-700-in-2021/?sh=14c7b63c7cdc (Accessed April 3, 2022).

Song, Jae, David J. Price, Fatih Guvenen, Nicholas Bloom, and Till Von Wachter. "Firming up inequality." *The Quarterly journal of economics* 134, no. 1 (2019): 1-50.

Stephenson, Neal. *Snow Crash*. New York: Bantam Books, 1992.

Theta Labs, *Theta Ecosystem 2022 & TDROP Token White Paper*, August 2021, https://s3.us-east-2.amazonaws.com/assets.thetatoken.org/Theta-Ecosystem-2022-and-TDROP-Whitepaper.pdf?v=1628195175.16 (Accessed 3 April 2022).

Theta Labs, *Theta Whitepaper 3.0*, December 2020, https://s3.us-east-

    2.amazonaws.com/assets.thetatoken.org/Theta-white-paper-3-0-latest.pdf (Accessed 3

    April 2022).

Thurman, Andrew. "Barbados to Become First Sovereign Nation With an Embassy in the

    Metaverse." November 15, 2021.

    https://www.coindesk.com/business/2021/11/15/barbados-to-become-first-sovereign-

    nation-with-an-embassy-in-the-metaverse/ (Accessed April 3, 2022).

Timiraos, Nick. "Fed Weighs Proposals for Eventual Reduction in Bond Holdings." *The Wall*

    Street Journal. January 4, 2022. https://www.wsj.com/articles/fed-weighs-proposals-for-

    eventual-reduction-in-bond-holdings-11641292201 (Accessed April 3, 2022).

Tuttle, Hilary. "Facebook scandal raises data privacy concerns." *Risk Management* 65, no. 5

    (2018): 6-9.

WC3 Team. "Call for Participation in Metaverse Interoperability Community Group." *W3C*

    Community and Business Groups. April 27, 2021.

    https://www.w3.org/community/metaverse-interop/ (Accessed April 3, 2022).

Wyss, Jim, "Barbados Is Opening a Diplomatic Embassy in the Metaverse," *Bloomberg*,

December 14, 2021, https://www.bloomberg.com/news/articles/2021-12-14/barbados-tries-digital-diplomacy-with-planned-metaverse-embassy (Accessed April 3, 2022).

Ye He Lee, Michelle, "Seoul wants to build a metaverse. A virtual New Year's Eve ceremony will kick it off," *The Washington Post*, November 28, 2021, https://www.washingtonpost.com/world/asia_pacific/metaverse-seoul-virtual/2021/11/27/03928120-4248-11ec-9404-50a28a88b9cd_story.html (Accessed April 3, 2022).