

Explicitly Decoupling Network Value and Token Value

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ESE 290

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C 1.1) Introduction

Cryptonetworks are decentralized trust networks that provision a specific resource or service (storage, compute power, etc) coordinated via a programmably scarce digital token (or cryptoasset). The scarcity of supply is enforced by a blockchain or consensus network and the incentive models that drive supply and demand are embedded within the network. Cryptonetworks are much different than centralized web services in that the service is produced by a network of nodes instead of a rent-seeking middleman. These nodes, who are independent and need not trust each other, collaborate to provide utility in exchange for the native asset of the network. And, to consume this service, whether it be storage or compute power, users must ‘spend’ these same tokens, which are freely tradable and priced by market forces.¹ Today’s assessment of a cryptonetwork’s value is largely based on market cap, calculated by multiplying the number of circulating tokens in a network with its trading price. In January 2018, the combined market cap of cryptonetworks peaked at \$830B. As of April 5th, 2018, the market cap stands at \$140B, the result of an 83% correction within a 4-month period.² Extreme market cap swings, even amongst the most legitimate cryptoassets, are far too common. Take Bitcoin, the largest cryptonetwork by market cap. While Bitcoin’s long term trend has been nothing short of exponential growth, it has experienced more than a dozen corrections of greater than 30%.

Bitcoin (BTC) Historical Corrections						
List of Bitcoin major corrections $\geq 30\%$ (from ATH levels) since January 2012						
Correction Period $\geq 30\%$						
Correction Start Date	Correction End Date	# Days in Correction	Bitcoin High Price	Bitcoin Low Price	% Decline	\$ Decline
12 Jan 2012	27 Jan 2012	16	\$ 7.38	\$ 3.80	-49%	-\$ 3.58
17 Aug 2012	19 Aug 2012	3	\$ 16.41	\$ 7.10	-57%	-\$ 9.31
6 Mar 2013	7 Mar 2013	2	\$ 49.17	\$ 33.00	-33%	-\$ 16.17
21 Mar 2013	23 Mar 2013	3	\$ 76.91	\$ 50.09	-35%	-\$ 26.82
10 Apr 2013	12 Apr 2013	3	\$ 259.34	\$ 45.00	-83%	-\$ 214.34
19 Nov 2013	19 Nov 2013	1	\$ 755.00	\$ 378.00	-50%	-\$ 377.00
30 Nov 2013	14 Jan 2015	411	\$ 1,163.00	\$ 152.40	-87%	-\$ 1,010.60
10 Mar 2017	25 Mar 2017	16	\$ 1,350.00	\$ 891.33	-34%	-\$ 458.67
25 May 2017	27 May 2017	3	\$ 2,760.10	\$ 1,850.00	-33%	-\$ 910.10
12 Jun 2017	16 Jul 2017	35	\$ 2,980.00	\$ 1,830.00	-39%	-\$ 1,150.00
2 Sep 2017	15 Sep 2017	14	\$ 4,979.90	\$ 2,972.01	-40%	-\$ 2,007.89
8 Nov 2017	12 Nov 2017	5	\$ 7,888.00	\$ 5,555.55	-30%	-\$ 2,332.45
17 Dec 2017	2 Feb 2018 *	48	\$ 19,666.00	\$ 8,094.80	-59%	-\$ 11,571.20

Bitstamp exchange prices (BTC/USD)

*indicative correction end date and bitcoin low price

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¹ Placeholder VC Thesis Summary

² <https://coinmarketcap.com/charts/>

³ <https://thebitcoin.pub/t/bitcoin-historical-correction-since-2012/28687>

What does this mean for those involved? The combination of extreme price volatility and general upward price movement naturally shifts the conversation towards what the value of a cryptonetwork is (or should be). Given the nascency of the space and the highly speculative behavior that comes with it, determinants of value remain subjective and markets overpriced. More importantly, the cryptoasset and its native network have yet to experience a standardized and fully adopted paradigm shift from our traditional understanding of valuation and value drivers in traditional asset classes (equities, commodities, etc.).

Broadly, we can classify the stakeholders who hold an interest in understanding cryptonetwork value as follows:

- ***Token Holders/Users:*** For token holders, understanding how a network generates and captures value is crucial if they are to effectively choose the tokens they ‘hold’ or ‘spend’ beyond speculation. At the highest level, it is in a user’s best interest to be able to explicitly identify the purpose and utility of a cryptonetwork’s native asset and the resource or service the cryptonetwork aims to provision. In other words, understanding *how* the network provisions a resource or service, which directly relates to *how* the network generates and captures *value*. More practically, a cryptoasset that aims to be a store of value asset should provision the service/resource much differently than one that aims to provide low cost storage. This also means defining and driving value should be different. This implication for the (potential) token holder is immense.
- ***Miners/Validators:*** Traditionally, nodes that help maintain the security and legitimacy of the network by carrying out computational tasks or staking a portion of their assets to incentivize honest decision making are financially rewarded with the network’s asset. Part of the innovation of cryptonetworks is an engineered financial incentive structure that eliminates the need for a trusted party with a marketplace of competing and honest nodes. These nodes therefore have an incentive to understand cryptonetwork value, and in specific the asset that they are rewarded with, if they are to successfully profit from their decision to ‘work’ for the network.
- ***Developers:*** Developers’ incentives to understand cryptonetwork value drivers lies in maximizing long term usage of the network while being able to retain value for themselves. Token distribution models are commonly framed to allocate a portion of total token supply to the team and developers, analogous to an employee option pool. If the underlying belief is that token value will increase with usage, developers have an incentive to design a protocol that facilitates usage of the network. For certain networks however, this belief remains overly simplistic, as there is and should be a distinction and decoupling between token value and network value generated (or

usage), as will be discussed. Developers' ability to understand this distinction will be crucial in optimizing protocol design.

- ***Investors/Speculators:*** Understanding value drivers is crucial to developing long-term investment strategies. If an investor's expectation of financial returns is to be realized, a derivation of where value is generated and captured is essential. In equities for instance, value is derived from profits and margins. Is there an analogous framework investors can apply to cryptonetworks?

An Overview on The Importance of Expanding the Cryptonetwork Value Paradigm

By introducing the general landscape of the importance of understand cryptonetwork value, we can now begin to decompose what the current framework for understanding value entails and assess the areas of expansion that are important in advancing our understanding. To understand cryptonetwork value, the industry often starts by making analogies between 1) traditional equities and cryptonetworks and 2) economies and cryptonetworks. In doing so, the following has been realized and established: Traditional equities have one goal: to maximize shareholder value. This is accomplished by maximizing profit and margins and modeled out using a DCF. In cryptonetworks, however, there is no idea of profits. It is better to compare them to an economy that bootstraps supply and demand through incentive models. Thus, DCFs are ill-suited and it makes more sense to model the network using something like the equation of exchange, which will be further explained. Furthermore, the "no profit" idea suggests that efficiencies do not accrue to network value (unlike in traditional equities). Ex: "Tokenization" leading to \$1 trillion of efficiency improvements (cost reductions) will result in lost value extraction. Ultimately, long term returns or value accruals will come from assets aimed at being stores of value/medium of exchange. This also implies that network usage and token value are not necessarily correlated, especially as it pertains to cryptonetworks that aren't SOVs.

However, it seems that discussion around token models and cryptonetworks doesn't reflect the above. That is, our mindset remains "profit-driven". While cryptonetworks and their native assets act more like economies, the go to analogy for many remains Share : Equity :: Token : Cryptonetwork. As a result, there appears to be increasing priority around maximizing token value instead of maximizing network usage. Additional reasons contributing to this "profit-driven" mindset include:

1. Most involved in crypto are "investors and traders".

2. Initial exposure to crypto is usually through Bitcoin. As a store of value, the ability for bitcoin to capture value in the long run is essential. People's perception of how a cryptonetwork should function is sometimes anchored by this idea.
3. Most importantly, there is no explicit distinction between network value (driven by usage and total value exchanged) and token value.

In understanding the current landscape and how value of networks are represented, network value and token value are either conflated or their distinction is merely implied. In order to better understand cryptonetwork value drivers, particularly as it pertains to cryptocommodities (or utility tokens), we must expand the existing paradigm by explicitly decoupling network value generated and network value captured (or token value). Doing so sheds light on interesting questions about token model priorities, which is extremely important for the advancement of the space. Much of today's design discussion is centered around maximizing token value, potentially at the cost of the network's long term viability and usage. With traditional equities, management unequivocally aims to maximize shareholder value by maximizing profit and margins. Should this same approach apply to cryptonetworks?

More generally, given the nature of cryptonetworks, determining value should depend on whether we are discussing the value of the network generated or the value captured by the native asset of the network. If a cryptonetwork is to act as an decentralized trust network intended to democratize information and open access to restricted pockets of freedom, what should design priorities around 'value' be? Should network designs prioritize maximizing value retention or value generation? Naturally, the ideal design is one that maximizes both. But, is there a tradeoff between the two? These discussion opens up the conversation for such questions. Furthermore, making this explicit distinction will allow for a better understanding of distinguishing between other traditional asset classes.

Existing Literature

Before explaining the methods and exactly how we will go about showing this distinction and ultimately discussing the implications of this distinction, we provide an overview on the state of understanding around cryptonetwork value and valuation. This will also allow us to further highlight the importance behind why this type of paradigm expansion is important.

To begin, cryptocurrencies have only existed for a decade, and cryptocurrencies beyond Bitcoin for only about 6 years. For that, reason, academic literature on the space is very sparse. Most of the literature in the space is focused exclusively on the technological stack of cryptonetworks with very little consideration about the economic dynamics of these networks. More importantly, the literature in the space that does cover ideas that are relevant to this paper are largely in the form of blogs. When running a search about cryptonetwork value and valuation on google scholar, zero results appear. For that reason, the strategy for finding literature in this space is effective only using a top down approach. That is, rather than look at individual publications about certain topics, the best method is to look at a few authors who have written about the space and stick to these authors when framing initial sentiment around value. While most of these authors were not academically peer reviewed, many have published books (through McGraw), have a large social media following (through Twitter), and have been successfully working in the industry for years as thought leaders.

The current literature around cryptonetwork value is primarily focused on cryptonetwork valuation. That is, finding ways to understand what the price of an asset actually should be. However, given the intersection between how the price of the token may ultimately be affected by the manner in which the token is engineered, much of this discussion is in parallel with the actual mechanics of the software. Discussion around valuation has led to research around how specific models and specific cryptoassets may end up poorly capturing value and therefore suggest a need to find ways in which the cryptonetwork can better capture value at the token model. However, therein lies the issue with not making a decoupling between network and token value. There is an immediate jump from valuation to token model mechanics and prioritization of maximizing token value without any consideration that there is a difference between the network value generated and the token value captured. Ultimately, blindly focusing on one side of the cryptonetwork value paradigm comes at the cost of a cryptonetwork's viability.

Methods

The method in this research consists of both a qualitative and quantitative component. Both components, while separate, are complementary. We first explain why exactly token value and network value are decoupled. We then explain the difference between network value generated and token value captured, as they are often conflated or their distinction merely implied. In explaining the difference, we present the quantitative component of this analysis, which will consist of looking at valuation frameworks and how these valuation frameworks can show this decoupling.

The model, which will be explained in detail, provides a base for understanding valuation models using the equation of exchange. This will ultimately enable collaborators or competitors to duplicate the setup for further work. In fact, the initial model was taken from a previous individual, Chris Burniske, who in his literature encouraged other individuals to use the model to further advance the paradigm.⁴ We will essentially be building on top of the model in order to show how network value and token value are decoupled. We will also use the model in order to explain the equation of exchange and the exact valuation method used. We will then use this model to explain how different token designs have been developed as a result of some of the realizations of working with this model.

Given the nature of this research, there is very little equipment, supplies, or software that will be needed to complete this project. As mentioned, the model has been created and edited through excel. Furthermore, these models will not need any additional software or equipment to fully build them out. The essence of this research is to make this distinction, show why the distinction occurs, and explain the implications of this distinction for future work. For that reason, this research is not experiment based and therefore will not go through the scientific method in the most traditional sense.

Shaping the Paradigm

Traditional asset classes have had a long history of framework development around value. To begin the conversation of how to develop a cryptonetwork value framework, we first define the cryptoasset as a new asset class that holds distinct economic characteristics. The relevant context surrounding this idea has been laid out by Chris Burniske and Jack Tatar in *Cryptoassets*. In it, they posit the following:

Taken from Robert Greer's *What is an Asset Class, Anyway?*, an asset class is defined as "a set of assets that bear some fundamental economic similarities to each other, and that have characteristics that make them distinct from other assets that are not part of that class."⁵ Traditional assets are commonly categorized into *capital assets* (such as a stock or a bond), *consumable and transformable assets* (such as a physical commodity), and *store of value assets* (such as currency or fine art).

Classifying an asset into a specific asset class is based on the economic characteristics of the asset. These characteristics boil down to governance, supply schedule, use cases, and most importantly in the context

⁴Burniske, Chris. *Cryptoasset Valuations*

⁵ Greer, Robert J. "What is an asset class, anyway?." *The Journal of Portfolio Management* 23.2 (1997): 86-91.

of this paper, basis of value.⁶ As we will explore, a cryptoasset's basis of value differs from traditional asset classes; traditional valuation tools are thus inapplicable. We highlight the importance of continuing to form a new paradigm for understanding a cryptonetwork's value by first acknowledging the cryptoasset as a completely separate and new asset class with its own distinct economic characteristics.

Cryptoasset Taxonomy

Both the utility and usage of a cryptoasset varies from network to network. Investigation of this topic will be limited to single-utility protocols.⁷ That is, cryptonetworks that provision a single digital resource. Examples of such resources include storage, bandwidth, transcoding, and compute power. To give context as to where these protocols are situated in the larger cryptoasset taxonomy, we provide an overview of the cryptoasset taxonomy⁸

⁶ Burniske, Chris, and Jack Tatar

⁷ While the examples that are given and the primary focus is indeed single-utility protocols, much of the analysis and questions raised can be applied to other cryptoasset subclasses. Single utility protocols were chosen to 1) emphasize the importance of the SoV component of a protocol and 2) more easily project the underlying application and usage of a token (regardless of whether the token ended up as a SoV)

⁸ Carter Nic, A cross sectional overview of cryptoasset governance

The discussion and modeling will be solely focused on the protocol token/cryptocommodity/utility part of the taxonomy. The important takeaway from outlining this taxonomy is to explain that each subclass of cryptoassets has its own basis of value and therefore must be modeled differently. As will be explained in the next section, this is important in ultimately understanding where the nature of this decoupling occurs.

Understanding the nature of network value and token value decoupling

As mentioned, the distinction between network value and token value exists. We are not creating this distinction. Rather, we are shedding light on this distinction and highlighting the importance of being more explicit about this distinction in understanding cryptonetwork value. For that reason, part of the method results comes in the form of understanding why this distinction occurs in the first place. More specifically, explaining the nature of this decoupling at its core. For the reader, it may help to understand at a high level why this decoupling occurs in the context of what was previously discussed about asset classes. Below is a diagram that was created as a part of outlining this decoupling that explains its nature. The diagram below is the core of what this research intends to provide for the cryptonetwork valuation paradigm (Note: this diagram has also been attached as a separate document as it may be difficult to read it on this page. Nonetheless below the diagram is its fleshed out explanation.)

The diagram above explains where this decoupling occurs if we take a step back and look at the full paradigm. We start by acknowledging that the cryptoasset is a new asset class that has a different basis of value from other asset classes (Background was provided in *Shaping the Paradigm* section). To further elaborate here, let us give an example of why this is such the case. “A share of stock represents a proportional right to a permanent stream of cash flows generated by a business, meaning it derives all of its value from profits and margins.”⁹ Tokens, on the other hand, as previously mentioned have no notion of profit, and thus a traditional discounted cash flow cannot be used. This therefore shows how the basis of value compared to other traditional asset classes is different. Now, we can take this idea a step further and claim that the cryptoasset as a new asset class is a superclass with subclasses, as highlighted in the cryptoasset taxonomy. These subclasses too have a different basis of value. For instance, a store of value asset, like Bitcoin¹⁰, will be valued differently than an asset that provisions storage or bandwidth, like Filecoin¹¹, which will be different than an asset that helps settle bank transactions, like Ripple¹². Furthermore, within subclasses, the cryptonetworks powered by a native asset provision a different resource or service and the token themselves serve different mechanical purposes. For instance, a “utility token” might provision storage in one cryptonetwork and bandwidth in another cryptonetwork. While both cryptonetworks fall under the same subclass, that is cryptocommodities, the actual resource being provisioned varies. We take this variation a step further in explaining that the nature of what the native asset does in the network also varies. That is, the token itself may serve a different purpose depending on the cryptonetwork. For instance, one token may be used purely as a means to pay for the service (proprietary payment currency model), while another token may be used to provide a marketplace exclusively for suppliers of the token (work model). The implication of these realizations is that there is a natural distinction between network value generated and network value captured (or token value). The network value generated, as explained, is unique. And, the degree of and mechanism for capturing value at the token level is unique. This idea, which naturally occurs, has not been explicitly stated in any of the literature and is important in understanding cryptonetwork value. This notion, is the essence of our research. Let us go further in explaining exactly what token value (or network value captured is) and network value generated.

⁹ Burniske, Chris. Cryptoasset Valuations

¹⁰ Satoshi Nakamoto, Bitcoin Whitepaper

¹¹ Juan Benet, Filecoin whitepaper

¹² Ripple whitepaper

Network Value Explained

As previously explained, cryptonetworks are considered mini-economies. As such, the network value they generate is often referred to as “GDP” and is a strong indicator of usage and network health. Given the public nature of blockchains, on-chain metrics are used to determine this value exchange, most commonly through the on-chain transactional volume of the network (although there are several limitations to this metric). Thus, network value can be defined as the total exchanged value or the economic output of a cryptonetwork. The important idea to highlight here is that when discussing cryptonetwork value, very little of today’s literature discusses the value of a cryptonetwork by its economic output. Rather, the majority of the discussion around value takes place at the token level. Understanding that there is a clear distinction between the two raises questions as to whether or not this is necessarily the right approach in discussing cryptonetwork value.

In forecasting network value, most of the literature market sizes. We see this in the Filecoin whitepaper for instance, which states the potential of capturing around 50% of the total storage market.¹³ As has been discovered, most assumptions in determining the total addressable market center around the specific resource being provisioned. As token models become increasingly understood and tested, we may perhaps realize correlations between network usage/accessibility and token model mechanics, independent of the actual resource being provisioned. Similar to how a token model design might capture network value more effectively, so too might be the case for generation. Consideration of this possibility is important when determining and forecasting the potential network value of a cryptonetwork.

Other information around understanding network value is outlining how exactly network value is represented. If network value is calculated as the product of the price and quantity of the resource provisioned (as will be discussed in the later section), then an efficiency in provisioning that resource will yield a lower network value. Unlike in traditional equities, cost efficiencies in cryptonetworks do not accrue to the asset or exchanged value. Should efficiencies in cryptonetworks rightfully be reflected by lower network values? Intuitively, a more efficient network should deem it more valuable. Perhaps this opens the conversation for finding ways to assess cryptonetwork value in which efficiencies are positively reflected. Or, perhaps conversation around the need for adjusting network value, similar to inflation adjustments in a country’s GDP, should be considered. These questions are brought up as a result of making this decoupling.

¹³ Benet, Juan. Filecoin Whitepaper

Token Value Explained

In essence, token value is the portion of network value that is “captured”. Nonetheless, as we will see when we model the value of a token, the ability for the network to capture value can be changed by toggling just a few parameters. For that reason, it is invalid to say that token value is directly correlated to network value. Although through the equation of exchange, there is a correlation, this correlation can be heavily manipulated based on what the exact model of the cryptonetwork actually is. Highlighting this point further sheds light on the importance of making this distinction. That is, depending on the network design, the mechanism for capturing value at the token level and the extent to which that value is captured varies, independent of the usage of the network. This is an extremely important point. The previous assumption that token value increases with usage of the network therefore is deemed invalid, and this decoupling is further highlighted as a result. Below are a few examples of the different ways in which token models may capture network value differently:

Work Utility Model

The token value in a work utility model would be strongly driven demand amongst contributors/providers. “The model presumes distributed contributors must stake the native network token to earn the right to perform work for the network. The chance that a given one is awarded a job request is proportional to its amount of staked tokens, as a fraction of all tokens staked by competing contributors at the time. If the work is deemed “correct”, it gets rewarded with fees; if “incorrect”, its supporting stakes can be slashed.”

¹⁴

Access Based Token

The token value in an Access Based model is driven by an end-user’s demand for tokens. If the demand for tokens grow, the platform’s usage increases, thereby making these credits more valuable. The access based token model is “a model with two tokens, one meant for staking, the other meant for paying fees, where the former (primary token) functions as a fee credit (secondary token) generation machine. The amount of secondary tokens minted for every primary token staked varies according to platform usage, usually giving access to a service at a fixed cost - the effect being similar to that of holding a license.”¹⁵

¹⁴Pereira, Felipe Gaúcho. On the immaturity of tokenized value capture mechanisms

¹⁵Pereira, Felipe Gaúcho. On the immaturity of tokenized value capture mechanisms

Proof of Burn Tokens

The token value in a proof of burn model is strongly driven by rates of supply burn and supply issuance. “Tokens function as a means of payment, but instead of circulating in the form of fees, they are burned, meanwhile referencing the service provider that each “payment” refers to, and entitling them to receive a portion of fixed block rewards, according the amount of “burns” that reference each service provider in that block.”¹⁶

Now that an illustration of the nature of this distinction has been presented, we now discuss how tokens are valued, in the most widely accepted framework.

How are tokens valued?

There are several mechanisms in which individuals have tried to value tokens. We will discuss in detail the one that is most widely adopted. That is, a model of token value through the equation of exchange. Other ways of modeling token value include tying the value to the external cost to produce the asset¹⁷, and tying the value to the cost of the computing resources to maintain the asset’s blockchain.¹⁸ Both of these methods of valuing a cryptoasset breakdown in logic under specific circumstances and further discussion around why this is the case is beyond the scope of this research. For the purpose of this research, we can safely assume that the most sane way of valuing a cryptoasset is using the equation of exchange. Before explaining the equation, let us elaborate on how one might think of the fundamental drivers of a token.

Broadly speaking, there are two drivers of a cryptoasset’s basis of value, first introduced by Chris Burniske¹⁹: utility value and speculative value. Utility value refers to what the underlying blockchain is used for and therefore drives demand for the asset if it is needed to access the resource. Speculative value is driven by people trying to predict future network usage that may translate to cryptoasset demand. This can otherwise be referred to future expected utility value.

Explaining the Equation of Exchange

¹⁶Pereira, Felipe Gaúcho. On the immaturity of tokenized value capture mechanism

¹⁷Hayes, Adam. A cost of production model for bitcoin

¹⁸ Pfeffer, John An institutional take on cryptoasset investing

¹⁹ Burniske, Chris. Crypto J Curve

As outlined, the core of understanding valuation for cryptonetworks starts with the equation of exchange. The equation of exchange in its original form is used in classical monetary economics. However, literature around slightly modifying this equation and applying it to cryptonetworks seems to be the most widely accepted manner to determine cryptonetwork value.²⁰ The importance in highlighting the equation of exchange and breaking down its component comes from the fact that the model presented is largely based on it. We provide a simple overview of the equation of exchange in the context of classic macroeconomics and a much more detailed breakdown in the context of cryptonetworks as an effective way to setup the context of our model.

What is the Equation of Exchange?

Expanding on the idea of philosopher David Hume, the equation of exchange was originally stated by John Stuart Mill. In 1911, the algebraic formulation was determined by Irving Fisher. At the highest level, the equation of exchange is an equation that illustrates the relationship between money supply, velocity of money, the price level and an index of expenditures.²¹ This relation is:

$$M * V = P * Q^{22}$$

Where, for a given period, M represents the average total nominal amount of circulating money supply, V represents the average frequency for which a unit of money is spent, P represents the price level, and Q represents the index of expenditures.

The use of the equation of exchange is two fold: It allows for the representation of one of the quantity of theory's founding principles (that is, money supply increases relate to price level increases). Furthermore, it is used as a means to determine money demand by solving for 'M'.

With these principles, the equation of exchange has often been used in modeling cryptonetworks and primarily solving for this 'M', which ultimately would determine the value of the token by dividing M by the number of tokens in circulation.

²⁰Burniske, Chris. Cryptoasset Valuations

²¹ Byron Higgins, Velocity's Second Dimension

²² Byron Higgins, Velocity's Second Dimension

In cryptonetworks, M represents the size of the asset base, V represents the velocity of the asset, P represents the price of the digital resource being provisioned and Q represents the quantity of the digital resource being provisioned. As mentioned, finding the value of the token is by figuring out what M is. Now, let us go into a little more detail on the $P * Q$ side of the equation in cryptonetworks, which is essentially the network value generated. P is not the price of the cryptoasset, but rather the price it costs to provision the resource the cryptoasset provides

There are two primary takeaways from explaining the equation of exchange in a cryptonetwork setting. The first takeaway is as can be shown in the model, the equation of exchange is the primary equation used in the sensitivity analysis and modelling out a protocol. Secondly, we see that PQ , which is the economic output or network value generated is, under this equation related to M , or the token value captured. However, since velocity is really the only variable that binds this relationship, an understanding of velocity will suggest that token value captured and network value generated are indeed decoupled. The reason for this is because artificially manipulating velocity would alter the token value and misrepresent the total societal value generated. The point in understanding this is its differentiation with traditional asset classes in determining this value. Whereas in a traditional equity, projecting increases in revenue directly relate to changes in the stock price, projecting increase in usage in a cryptonetwork does NOT directly relate to increase in the token value.

Model

Now that a foundation explaining the underlying nature of decoupling network value and token value, we can show this decoupling through the mathematical model of the equation of exchange. This model, which has been attached as an accompanying document was taken from Chris Burniske's paper on introducing cryptoasset valuations. The model was reconfigured and changed in order to produce specific outputs that would more explicitly show this decoupling. We can explain the core of the model as follows. The model is a hypothetical model of a bandwidth token that is used a proprietary currency. That is, the token is used to access the digital resource or service provisioned. The model is primarily used to understand the value levers of a cryptonetwork. For the purpose of this research, the model was configured in order to produce outputs that showed an explicit decoupling of network value generated and token value. With the model, I was able to produce sensitivity analyses on several parameters that might affect both token value and network value. The goal was to then graph the sensitivity analysis and show how a change in one of these parameters may change token value different to how network value is

changed. This would then mathematically show how network value and token value are decoupled as well as provide a means in which future contributors may change the model accordingly. In this model, Chris Burniske initially divides the model into four sections. Section A calculates the number of tokens in the float, Section B quantifies the economy of the protocol using the equation of exchange (which is explained in the previous section), Section C projects the percentage adoption of the cryptoasset within its target market (which feeds into Section B), and Section D discounts future utility values back to the present. I took parameters from each of these sections that ultimately changed the network value and token value and graphed them in order to represent the decoupling. Some of these assumptions are irrelevant in showing this decoupling and were therefore discarded in the updated model. The parameters that I decided to run a sensitivity analysis on were token velocity, cost efficiency of provisioning the resource, % of token supply in circulation, and saturation percentage. I also decided to run a sensitivity analysis on a model-exclusive assumption, that is, the discount rate. Let us briefly explain each of these parameters before displaying the results of our findings. Token velocity, as mentioned in the explanation of the equation of exchange, is the amount of times the asset turns over within a given time period. The cost efficiency of provisioning the resource was previously mentioned in our definition of network value and essentially is the P component of the equation of exchange. The model did not actually compute a value for cost efficiency and thus had to be added and configured accordingly. The changes and additions made to the model can be seen in the attached excel. Cost efficiency is a representation of the current P versus the maximally optimal P. I have defined it as a percentage. That is, let us say that the most efficient a network can provision a resource is X. However, the network as it currently stands only provisions it as Y. Then the % efficiency of provisioning that resource is $(X/Y) * 100$. The % of token supply in circulation is the % of supply that is readily available to be accessed and traded and not held by individuals either as a store of value or as a “staker” of the network. A staker of the network adds security of the network by locking up a certain number of tokens for a specific period of time and in return is able to participate in the process of determining valid transactions. By staking some of their own tokens, these nodes have an incentive to honestly work for the network, or else their staked tokens will be lost. However, staking tokens will eliminate it from the circulating supply and thus would not be considered in the economy of supply and demand for the actual resource being provisioned. Finally, saturation percentage is the percentage that the cryptonetwork takes in the calculated total addressable market. With an explanation of these parameters, we now model a sensitivity analysis of these parameters against both token value and network value. The full model with the accompanying graphs and an explanation of the variables can be accessed in the excel document.

Sensitivity Analysis 1: Token Velocity

Sensitivity Analysis 2: Cost efficiency of provisioning resource

Sensitivity Analysis 3: % of token supply in circulation

Sensitivity Analysis 4: Saturation Percentage

Sensitivity Analysis 5 (subjective, valuation-exclusive parameter): Discount rate

As can be shown from the model there is a clear decoupling between network value and token value. None of the parameters changed network value and token value in the same manner. However, we see the limitations of using such a model in that it is unrealistic to believe that an artificial token velocity suppression, or % of token supply circulating may not change the output or network value generated, unlike what is indicated in the graph. Additionally, choosing these parameters and assessing the dynamics of these parameters in cryptonetwork value sheds light on a few other interesting points. For instance, as previously mentioned, if network value is calculated as the product of the price and quantity of the resource provisioned, then an efficiency in provisioning that resource will yield a lower network value. Unlike in traditional equities, cost efficiencies in cryptonetworks do not accrue to the asset or exchanged

value. Should efficiencies in cryptonetworks rightfully be reflected by lower network values? Intuitively, a more efficient network should deem it more valuable. Perhaps this opens the conversation for finding ways to assess cryptonetwork value in which efficiencies are positively reflected. Or, perhaps conversation around the need for adjusting network value, similar to inflation adjustments in a country's GDP, should be considered.

Conclusion/Future Work

Eventually, the crypto industry will understand cryptoassets as well as other traditional asset classes understand their bases of value. For now, it is important that we continue to expand the paradigm starting with an explicit decoupling of network and token value. Ultimately, the purpose of a token (determined by the token model design) must complement the specific resource or service the network provisions. Unfortunately, what is deemed complementary is subjective, but a better understanding of value drivers may ultimately lead to a provisioned service/resource-dependent convergence of token models. The graphs above suggest some very interesting, rather nuanced ideas around the limitations and implications of showing this decoupling in this manner. It would be naive to think that network usage (and therefore network value) wouldn't be affected by token velocity or other parameters, for instance, which is what is illustrated in the sensitivity analysis. This realization is ultimately what highlights fundamental importance of this research. The essence of this paper does not make an attempt to explain mathematically the extent of this decoupling and the exact relationship. Rather, through this decoupling, we are able to shed light on the current limitations of these value frameworks. And that is, that there is no explicit mention of a decoupling. When we do try to show this decoupling using a traditional model, we come to the realization that under the model the decoupling certainly does exist. However, it is extremely doubtful that the nature of this decoupling is actually accurate under this current model. That is, we cannot rely on the model that tells us that a change in velocity does not affect network value or usage. This sheds light on interesting notions around token model design and second order effects that we have yet to realize or consider. If as shown in the graph, a high token velocity would decrease the token value but the network value would remain constant, then it would make sense to attempt to suppress token velocity, correct? Well, not necessarily so, as artificial token velocity suppression mechanisms may inhibit the future usage and utility of the network. This realization is crucial in designing token models and opens up the conversation for extremely interesting ideas around token model design priorities. Could deliberate mechanisms for maximizing token value (velocity suppression, modified token model design, etc.) affect usage and usability of the network? Do token models have second order effects on network value

generation that we have yet to discover? How might we determine this? What should design priorities around 'value' be? Should network designs prioritize maximizing value retention or value generation? Naturally, the ideal design is one that maximizes both. But, is there a tradeoff between the two? These kinds of questions can only be answered once there has been a clear and established understanding that there is a decoupling between network value and token value.

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This is the most important successor paper for the second featured paper and is cited more than 200 times. This lays the foundation for all analysis and application of Bitcoin as the backbone protocol. This is extremely relevant to my research as the gateway to alternative protocols is bitcoin. For that reason,

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This is one of the most important books on understanding the fundamental architecture of Bitcoin. It has been cited more than 360 times and lays the foundation for individuals to familiarize themselves with cryptocurrencies. The book highlights several main points about how to think about the generation of bitcoin and its mathematically metered supply. This is extremely relevant to the research I am conducting as other protocols have their own supply issuance models, which in turn may affect valuation, and hence is essential for me to understand.

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