THE STRUCTURE ECONOMIC BLOC

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Abstract. We propose a construct for a novel form of virtual economic zone: the Structure Economic Bloc. The Structure Economic Bloc is, *inter alia*, a member-governed economic zone; a blockchain-based ledger and unit of account: `STXR`; a set of `STXR` farming rights; a novel mechanism for estimating the optimal earning rates for performing farming activities; an algorithmic minting rate control mechanism based on the Bitcoin Network; and a decentralized autonomous foundation chartered to advance the well-being of the Bloc. The purpose of the Structure Economic Bloc is to maximize its value to its members and the growth rate thereof, as well as to provide access to a robust, productive economy to as many individuals as possible, regardless of where they reside.

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1. Introduction

Since the release of Satoshi Nakamoto's whitepaper[1], efforts to further develop non-sovereign economic systems have only intensified. With the release of Vitalik Buterin's Ethereum whitepaper[3], a small community of enthusiasts were shown that applications in cryptography were far from exhausted in its description for how an arbitrary, Turing-complete, public execution environment could operate with all of the guarantees provided by Bitcoin, and more. Ethereum, more than anything, set the stage for the first crypto bubble through its ease of use and flexibility to offer a means for its adherents to operate in a decentralized, trustless, and censorship-resistant manner, but also that of any other project making use of its core infrastructure. Tether was one such project. Although chain independent, Tether used Ethereum (and Bitcoin) to solve a problem that virtually every crypto enthusiast has: price instability. By mapping into a decentralized ledger the comparatively price-stable U.S. Dollar, Tether brought the dollar—and all fiat money by extension—unabashedly, unapologetically, and irreversibly into the Cryptographic Century. The stablecoin copycats that followed demonstrated unequivocally that blockchain was not solely an outlet for fringe, computer-scientific eccentrics lurking on the margins of society, but a technological *tour de force*, offering improvements to not only anything touching our financial lives, whether conventional or cryptographic, but to the very information systems on which they have come to depend. By this time in history, the number of new projects drawing on and extending from these core innovations reached a dizzying pace; however, no matter the hype, hysteria, and greed that fueled the ensuing flames of the great crypto crash of 2018, a few applications became exemplary if only for their relentless ability to stay on top of the worst project metric that just will not go away: price. Yes, while new symbols, new whitepapers, new ICOs all pushed and shoved to attract participants, the coins that had head-turning price action never seemed to struggle. Significant among these were the "exchange tokens": units of account providing utility to members of an exchange marketplace. Not unimportantly, exchange tokens as a class have enjoyed one of the most successful receptions from the market of any business application that has attempted to make use of distributed ledger technology. One possible explanation for this occurrence could be the popular use of "buy & burn": a policy of the token's sponsoring business to decrease its circulating supply via purchase and subsequent destruction, financed by the income collected from operating its core business. "Buy & burn" represents one particular way that capital can be redistributed from shareholders, on the one hand, to "token holders" on the other. More abstractly still, value redistribution policies provide an economic network—in this specific case, an exchange business—a mechanism to influence the distribution of possible future paths that the network may take as it evolves towards higher-value equilibria—an emergent phenomenon arising out of the collective action taken by its game-theoretic optimum-seeking participants.

Although successful, "buy & burn" represents one of an infinite assortment of value assignment policies that might be explored. Notwithstanding its success, there has been little improvement of this simple idea despite the myriad opportunities for more sophisticated value assignment policies that are made possible by the underlying technologies of the distributed execution environment offered by Ethereum and alternatives. Herein we describe the Structure Economic Bloc, a borderless, decentralized, radically transparent, member-governed economic zone whose guiding design principle is predicated on the hypothesis that choices governing the assignment of value as it is created remains one of the most potent yet overlooked forces that drive an economic network's forward evolution. Accordingly, in order to foster an economic zone capable of robust value creation, not only the canonical economic network properties—stores of value, units of account, fungibility, and broad accessibility—should remain first-class considerations but also, we contend, the very algorithm by which created value is assigned to the network and its participants. To overlook this fundamental force of economic evolution is to forgo perhaps some of its most potent means of organizing the unconcerted and otherwise random activities of its participants into an autonomous and spontaneously productive enterprise: self-interest, assignment, and accumulation.

2. Economic Zone

The Structure Economic Bloc is a borderless, decentralized, radically transparent, member-governed economic zone. The Bloc does not have geographic boundaries, remaining independent of the sovereign boundaries within which its members reside; the structures that support its affairs are provided through mostly[1] decentralized technologies; the manner and mechanisms by which it operates are made radically transparent to all those interested; and whose self-governance occurs by way of a member-mediated, direct democracy.

2.1. Unit of Account.

Like other economic zones, the Structure Economic Bloc makes use of a unit of account called `STXR`. `STXR` is blockchain-based, but it is independent of any particular blockchain. The `STXR` global ledger is composed of a set of independent subledgers that are programmatically linked, yet independently maintained by the smart contracts and host blockchain on which they exist. Within a member blockchain, `STXR` transactions are maintained on the local subledger. Transactions that involve two different member blockchains are facilitated by a pair of gateway contracts that ensure that `STXR` is conserved over the transaction so that there is no inadvertent creation or destruction. The `STXR` global ledger can be thought of as an omnibus account within which the member blockchain subledgers act as subaccounts. Consequently, Structure Economic Bloc members may custody their `STXR` in any digital wallet that are compatible with the member blockchains.

The purpose of `STXR` is to provide a means to organize, direct, and focus the efforts, ambitions, and activities of Bloc members onto those that most rapidly increase value within the Structure Economic Bloc. The kinds of activities that would most rapidly cause an increase in value is expected to evolve over time.[2] Consequently, the algorithm according to which `STXR` is minted and assigned is dynamically adaptable, providing the Bloc a means to recalibrate itself in response to ever-changing circumstances.

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[1] It is currently not possible to provide all of the systems and services required of an economic zone by purely decentralized means.

[2] For instance, it is apparent that Bitcoin hashing power has become extremely concentrated. Increasing the diversity of participating miners without an increase in hashing power would increase the value of the Bitcoin network more than increasing the hashing power without an increase in diversity. This wasn't always the case for the Bitcoin network.

2.2. **Purposes of the Structure Economic Bloc.** There are two primary purposes of the Structure Economic Bloc: value creation and economic access.

2.2.1. *Value Creation.*

Purpose 1. To maximize value creation for its members and the growth rate thereof.

A theory of value—what value is and how it can be created—is the foundation of economics. Due to its importance and expansive implications, we will not appeal to a theory of value directly in order to provide a practical means for achieving Purpose 1; Therefore, and in order to proceed in the meantime, we adopt the following heuristic:

Heuristic 1. U.S. Dollars quantify value.

As `STXR` is the unit of account in the Structure Economic Bloc, and `USD` is—as the world's reserve currency[6, 7],[3]—a heuristical quantificiation of value, then the value of `STXR` to the Bloc's members may be reasonably approximated by the amount of `USD` for which `STXR` can be exchanged.[4] Purpose 1 and Heuristic 1 collectively then imply:

Implication 1 ($\Longleftarrow$ P1 $\wedge$ H1). The Structure Economic Bloc *should aspire* to simultaneously maximize the price return and price stability of `STXR/USD` until such a time that the predicated heuristics may be replaced by any that are superior.

2.2.2. *Economic Access.*

Purpose 2. To provide members with a means of contributing value to and receiving value from a robust and productive economy—an economy that we hope will suffer from fewer negative externalities and other ills dragging down the spirit and common trajectory of humankind.

2.3. **Necessity.** Such a zone is needed because (i) virtually all economic systems—while in principle aspire to offer a level playing field—do not and cannot make up for the birthplace lottery[4, 5], the yields from which few participants are well-served; and (ii) most people in the world do not practically have access to a robust economy that is capable of productively absorbing the ensuing torrents of human need and capacity forthcoming in the decades ahead[8]. The meritable path forward can only be one that does not, yet again, insist on ignoring the lessons of history; it cannot replace king for president; feudalism for capitalism; aristocrat for investor; it must be a new kind of economic *structure* all together.

3. Economic Networks

3.1. **A Historical Inflection Point.** Historically, markets have repeatedly emerged in order to facilitate transactions of all kinds. Providing its participants with the ability to exchange one good or service for another has, more than anything else, motivated the market's *raison d'être*.

During the Age of Enlightenment[5], scholars of the then-burgeoning field of economics began to realize that markets, in fact, had been providing society with

[3] At the time of writing.

[4] We do not mean to imply an infinite regress. Rather, as a heuristic, we adopt `USD` as the unit of value, even though we know this is flawed.

[5] 1685-1815

another essential service that, until then, had astonishingly remained unobserved:[6] the price discovery mechanism.[7] *Price*, a mere by-product of organizing and facilitating the exchange of goods and services, in the span of years, suddenly and unwaveringly became *the* essential information of the day—the day of empiricism, liberalism, and the consolidating structure of sovereign power, the "nation state". Despite its gravity, and especially in light of the fallout from the obstruction of trading in GameStop and other stocks on January 28^{th}, 2021, only to highlight the *indispensability* of price, and its now-forever inseparable progenitor, the market discovery mechanism, risks understating the reality to a misleading degree. Our world, for better or worse, and now more than ever, revolves around price.

But that is not all. In fact, it is our view that the very structure and algorithm of the market discovery mechanism itself begs for promotion in order that its centrality in guiding us to truly fair and just markets might someday be realized, and if not to that degree, then at least to the level that we may see it for what it really is: a network parameter estimator.

Before continuing this story, however, we need to take a slight technical detour through the structure of economies themselves, after which we may better understand the perspective thus exhibited.

3.2. **Graphical State Machines.** Economies principally consist of agents and assets. Agents could be individual people, companies, nation states, economic zones, or similar entities. Assets are things that are commonly valuable to many agents.

3.2.1. *Asset Graphs.* We model assets in the economy as a sequence of graphs, $\{G_0, \ldots, G_k, G_{k+1}, \ldots\} = \mathcal{G}$, with index $k \in \mathbb{N}$. A particular element, G_k, is a directed graph that represents the k^{th} snapshot of the state of all assets.

Definition 3.2.1.1 (Head). Let the *head* of $\mathcal{G}$, as denoted by $h(\mathcal{G})$, be defined as:

$$\underset{\mathbb{N}}{\operatorname{argmax}}\{k \mid G_k \in \mathcal{G}\}.$$

Definition 3.2.1.2. Let t_G indicate the *time* at which $h(\mathcal{G}) = G$.

Definition 3.2.1.3. Let $\mathbb{G}$ represent the set of all possible graphs.

3.2.2. *Asset Nodes.* There are two ways of representing assets as nodes in a graph, G. The "Type I" representation uses nodes as the *aggregate* supply of the assets in the economy. Thus, for a particular asset a, the node ψ_a denotes its total supply in the economy. Consequently, a graph, G, only contains one node, ψ_a, to represent asset, a.

In the "Type II" representation, a node, $\psi_{a\eta}$, is used to represent only the supply of asset, a, that is *owned by* agent η. Thus, $\sum_\eta \psi_{a\eta} = \psi_a$. This Type II, *unaggregated* representation clearly provides more granularity for modeling purposes, however, we use both as the context may require.

Definition 3.2.2.1. Let $\mathcal{A}_G$ represent the set of all asset nodes in graph G.

[6] Or at least *unappreciated*.

[7] Although, retrospectively, we can observe many important contributions to what would later become known as "economics" springing out of ancient Athenian society, as well as medieval scholasticism, economics as we know it today, that is to say, modern *political economy* is, of course, more literally born out of the work of Adam Smith.

Definition 3.2.2.2. Let Ψ_G^{I} represent the set of all Type I asset supplies, $\{\psi_a \mid a \in \mathcal{A}_G\}$; and let Ψ_G^{II} represent the set of all Type II asset supplies, $\{\psi_{a\eta} \mid a \in \mathcal{A}_G \wedge \eta \in \mathcal{H}\}$.

3.2.3. *Conversion Edges.* An edge ε is represented as the ordered pair $\langle \psi_a, \psi_{a'} \rangle$ for $a \neq a'$ and $a, a' \in \mathcal{A}$ in the Type I node representation; and $\langle \psi_{a,\eta}, \psi_{a',\eta'} \rangle$ in Type II with the same contraints on a, a' as in Type I, as well as $\eta \neq \eta'$ and $\eta, \eta' \in \mathcal{H}$. A particular directed edge, $\varepsilon = \langle \psi_a, \psi_{a'} \rangle$, represents the means by which asset a can be converted into asset a'. An edge, ε_l, may have a *set* of parameters, Θ_{ε_l}, that govern the conversion it represents.

Definition 3.2.3.1. Let $\mathcal{E}_G$ represent the set of all edges in graph G.

3.2.4. *Agents & Value.* We model an agent, with index η, as a valuation function[8] $\nu_\eta : \mathbb{G} \to \mathbb{R}$.

Definition 3.2.4.1. Let $\mathcal{H}$ represent the set of all agents, with $|\mathcal{H}| = u$; and let $\mathcal{H}_k$ be the set of all agents corresponding to graph G_k.

Definition 3.2.4.2. Let $\mathcal{N}$ represent the set of valuation functions of all the agents, with $|\mathcal{N}| = u$.

3.2.5. *Operations.* Agents operate on $h(\mathcal{G})$ via *agent operations*, $\tilde{o} : G_k \mapsto G_{k+1}$. At time, t, the economy provides its agents with a set of *agent operations*, $\mathcal{O}(t) = \{\tilde{o}_j \mid j \in \mathbb{N}\}$.

Definition 3.2.5.1. Let $\mathcal{O}_k = \mathcal{O}(t_{G_k})$.

Note. $\mathcal{O}(t)$ may not be a constant function of time, and in practice, rarely is.

Proposition 1. *An agent η invokes a particular $\tilde{o}$ on $h(\mathcal{G})$ in order to change its current state from G_k to a new state, G_{k+1}:*

$$\tilde{o} : G_k \mapsto G_{k+1}$$

because

$$\nu_\eta(G_{k+1}) > \nu_\eta(G_k).$$

Remark 3.1. We believe this is a necessary premise, not only for economics, but for any study of conscious human behavior.

Definition 3.2.5.2 (Non-conservative operations). One class of operation warrants special mention because of its centrality in the Structure Economic Bloc. Consider an operation, $\tilde{o}^* : G_k \mapsto G_{k+1}$. Suppose that

$$\sum_{\eta \in \mathcal{H}} \nu_\eta(G_{k+1}) = \sum_{\eta \in \mathcal{H}} \nu_\eta(G_k) + \Delta v, \quad \Delta v \neq 0, \tag{1}$$

yet

$$\Psi_{G_k}^{\mathrm{II}} = \Psi_{G_{k+1}}^{\mathrm{II}}. \tag{2}$$

In such a case, $\tilde{o}^*$ has affected the global level of value (Eq. 1), but it did not affect the allocation of assets across agents (Eq. 2). Because asset allocations are invariant, $\tilde{o}^*$ cannot be a trade[9], but some other important type of operation that

[8]A neoclassicist would want to call this a "utility function". As we are not really sure what *utility* means, we speak of *value*, albeit semantically challenging as well.

[9]As defined in Definition 5.2.0.1

we describe later.[10] We refer to operations sharing the same properties of $\tilde{o}^*$ as *non-conservative operations* and denote them by $\breve{o}$, rather than $\tilde{o}^*$.

Definition 3.2.5.3. We refer to the quantity, Δv, as *value surplus* for $\Delta v > 0$ and *value deficit* for $\Delta v < 0$.

3.2.6. *State Machine.* With these primitives established, the graphical state machine representation of the economy, $\mathcal{M}$, is simply:

$$\mathcal{M} = (\mathcal{H}, \mathcal{N}, \mathcal{G}, \mathcal{O}, \Theta).$$

3.2.7. *Corollaries.*

Definition 3.2.7.1. Let $N(a)$ be the *neighborhood* of a, where

$$N(a) = \{a' \mid \langle a, a' \rangle \in \mathcal{E}\}.$$

Definition 3.2.7.2 (Degree). Let $\deg(a) = |N(a)|$ be the *degree* of asset a.

Corollary 3.2.7.1 (Currency). *A currency is simply that asset, a, whose degree, $\deg(a)$, is much greater than most. A "best" currency might be defined simply as $\operatorname{argmax}_{a \in \mathcal{A}}\{\deg(a)\}$.*

Remark 3.2. There are otherwise no material differences between a *currency* and any other asset.

Remark 3.3. Arbitrage opportunities exist because all Type II asset nodes do not have the same degree.

Corollary 3.2.7.2 (Value Creation). *When*

$$\sum_{\eta \in \mathcal{H}} \nu_\eta(G_k) < \sum_{\eta \in \mathcal{H}} \nu_\eta(G_{k'}), \quad k < k',$$

value has been created.

Definition 3.2.7.3 (Voluntary Trade). Consider an agent η for which

$$\frac{\partial \nu_\eta}{\partial \psi_{a\eta}} - \frac{\partial \nu_\eta}{\partial \psi_{a'\eta}} > 0,$$

and an agent η^c, for which

$$\frac{\partial \nu_{\eta^c}}{\partial \psi_{a'\eta^c}} - \frac{\partial \nu_{\eta^c}}{\partial \psi_{a\eta^c}} > 0,$$

when $G_k = h(\mathcal{G})$; that ν_η and ν_{η^c} are both differentiable; an edge $\varepsilon_+ = \langle \psi_{a'\eta}, \psi_{a\eta^c} \rangle$, with accompanying parameters $\Theta_{\varepsilon_+} = \{\pi_{a'a}, \phi_{a'}\}$; and an edge $\varepsilon_- = \langle \psi_{a\eta^c}, \psi_{a'\eta} \rangle$, with accompanying parameters $\Theta_{\varepsilon_-} = \{\pi_{aa'}, \phi_{a'}\}$, where $\pi_{aa'} = 1/\pi_{a'a}$. Let $\pi_{a'a}$ represent the amount of asset a' that can be traded for one unit of asset a from agent η to agent η^c; and let $\pi_{aa'}$ represent the amount of asset a that can be traded for one unit of asset a' from agent η^c to agent η. Let $\phi_{a'}$ represent the amount of asset a' needed to pay the marketplace or protocol that owns the edges ε_+ and ε_-. Let this marketplace or protocol be known as agent η_μ. The marketplace, η_μ, is said to *contribute* the operations $\tilde{o}_+$ and $\tilde{o}_-$ to $\mathcal{M}$. The agent, η, invokes $\tilde{o}_+$ for

[10] In Section 5

some amount y, while agent η^c invokes $\tilde{o}_-$ for the same amount y, on graph G_k. This causes $h(\mathcal{G})$ to change from G_k with nodes:

$$\psi_{a'\eta}(G_k) > y$$
$$\psi_{a\eta^c}(G_k) \geq \frac{y - \phi_{a'}}{\pi_{a'a}}$$

to G_{k+1}, which is identical to G_k except that:

$$\begin{aligned}
\psi_{a'\eta}(G_{k+1}) &= \psi_{a'\eta}(G_k) - y \\
\psi_{a'\eta^c}(G_{k+1}) &= \psi_{a'\eta^c}(G_k) + y - \phi_{a'} \\
\psi_{a\eta}(G_{k+1}) &= \psi_{a\eta}(G_k) + \frac{y - \phi_{a'}}{\pi_{a'a}} \\
\psi_{a\eta^c}(G_{k+1}) &= \psi_{a\eta^c}(G_k) - \frac{y - \phi_{a'}}{\pi_{a'a}} \\
\psi_{a'\eta_\mu}(G_{k+1}) &= \psi_{a'\eta_\mu}(G_k) + \phi_{a'},
\end{aligned}$$

where $\psi(G_k)$ indicates the value of ψ in graph k.

Remark 3.4. η and η^c jointly negotiate $\pi_{a'a}$; they own this parameter. Because η_μ effectively owns ε_+ and ε_-, it *dictates* $\phi_{a'}$, which is a form of rent.

Corollary 3.2.7.3 (Voluntary Trade Creates Value)**.** *A main result*[11] *of economics is that*

$$\begin{aligned}
\nu_\eta(G_{k+1}) &> \nu_\eta(G_k) \\
\nu_{\eta^c}(G_{k+1}) &> \nu_{\eta^c}(G_k) \\
\nu_{\eta_\mu}(G_{k+1}) &> \nu_{\eta_\mu}(G_k)
\end{aligned}$$

even though

$$\psi_{a'\eta}(G_{k+1}) + \psi_{a'\eta^c}(G_{k+1}) + \psi_{a'\eta_\mu}(G_{k+1}) = \psi_{a'\eta}(G_k) + \psi_{a'\eta^c}(G_k) + \psi_{a'\eta_\mu}(G_k)$$

At its most basic level, this is why trade occurs.

In order to clearly describe the mechanics of the Structure Economic Bloc, we employ the language developed in this section, lest our dialectic succumb a Sisyphean fate.

3.3. **Assignment of Surplus and Deficit.** Bringing our attention back to those non-conservative operations from Definition 3.2.5.2, a natural question to ask is *should*—and if so *how*—Δv be assigned? A normative question such as this can only be answered with respect to a schedule of priorities, which, for our purposes, have already been set forth in Section 2.2. Accordingly, "*Should* Δv be assigned" is logically isomorphic with "*Would* the assignment of Δv advance any of the Bloc's goals?" In order to offer an answer to this question, let us consider the motivations of an operating agent, η.

By Proposition 1, it is easy to see that

$$\frac{\partial \nu_\eta}{\partial \check{o}} > 0,$$

[11]Or assumption?

where, at the risk of abusing notation,

$$\frac{\partial \nu_\eta}{\partial \breve{o}} = \lim_{\boldsymbol{\theta} \to \vec{\mathbf{0}}} \nu_\eta(\breve{o}(G_k; \boldsymbol{\theta})) - \nu_\eta(G_k)$$

for some n-element vector $\boldsymbol{\theta} \in \mathbb{R}^n$ that parameterizes $\breve{o}$.

Proposition 2 (Motivation)**.** *We assume that*

$$\frac{\partial \mathbb{E}\left[N_{\breve{o},\eta} | \nu_\eta\right]}{\partial \nu_\eta} > 0,$$

where N is as defined in Definition 6.2.2.4.

This formal proposition can more casually be understood as "motivation" or "incentive"—*id est* the more value an agent receives from doing an operation, the more frequently or voluminously the agent might do it. This is a helpful stepping stone towards answering the simple question of what to do with Δv; however, considering the motivations of an agent in isolation is insufficient. Accordingly, we now turn our attention to the distribution of Δv between the initiating agent, as well as the non-initiating agents: the community.

Definition 3.3.0.1 (Externality Types)*.* Consider the Δv from Eq. (1). Suppose

$$\Delta v = \Delta v_\eta + \Delta v_{\mathcal{H}^c}. \tag{3}$$

where $\mathcal{H}^c = \mathcal{H} \setminus \{\eta\}$, and $\Delta v_{\mathcal{H}^c}$ is naturally $\sum_{\eta' \in \mathcal{H}^c} \Delta v_{\eta'}$. Further, consider the conditions in Table 1:

Table 1. Externality Types

		sgn $\Delta v_{\mathcal{H}^c}$		
		−1	**0**	**1**
sgn Δv_η	**−1**	I	II	II
	0	IV	V	VI
	1	VII	VIII	IX

With respect to the balance of Δv_η and $\Delta v_{\mathcal{H}^c}$, Table 1 enumerates the nine possible categories, which we refer to as Externality Types.

Type I: The agent and community are both harmed.
Type II: The agent is harmed, but the community is unaffected.
Type III: The agent is harmed, but the community is benefited.
Type IV: The agent gains nothing, but the community is harmed.[12]
Type V: Neither the agent nor the community are affected.
Type VI: The agent gains nothing, but the community is improved.
Type VII: The agent benefits, but the community is harmed.
Type VIII: The agent benefits without affecting the community.
Type IX: The agent and community are both benefited.

What, if anything, should be done in each of these situations is a question of ethics; however short of an analysis of ethics, there are a few things we can say intuitively:

Types I–III: We do not need to consider by Proposition 1.

[12]We believe the technical term for such an operation is "*being an asshole.*"

- Type IV: Obviously, this is a possibility that should be prevented if possible. Therefore, it would be beneficial to assign as much of $\Delta v_{\mathcal{H}^c}$ to agent η if possible.
- Type V: We do not need to consider by the conditions of Eq. (1).
- Type VI: It would be beneficial to assign at least some of $\Delta v_{\mathcal{H}^c}$ to agent η in order that the agent does this operation more frequently, thus creating more value by Proposition 2.
- Type VII: How this should be treated depends on whether $\Delta v_\eta > |\Delta v_{\mathcal{H}^c}|$ or $\Delta v_\eta < |\Delta v_{\mathcal{H}^c}|$. If the former, it would be better that the agent compensate the community by an amount equal to $|\Delta v_{\mathcal{H}^c}|$; and in the latter scenario, it would be better that we completely assign $\Delta v_{\mathcal{H}^c}$ to the agent if possible in order to reduce the frequency with which the operation is invoked.
- Type VIII: This is a good scenario but one for which value reassignment is not globally beneficial.
- Type IX: Reassignment may be beneficial depending on the sign of $\partial^2 \mathbb{E}\left[N_{\breve{o},\eta}|\nu_\eta\right]/\partial\nu_\eta^2$. If it is positive, at least partial reassignment from the community to the agent is beneficial; however, if it is negative, further consideration is required in order to find the optimum.

We believe this analysis is helpful for organizing the conceptual rules of the Bloc; however, it is not actionable until we consider the fact that only assets can be assigned, not naked value, as it is only a subjective function of the agent, η. Therefore, in order to make actionable this analysis of value assignment, we must additionally develop a means to measure value and subsequently reify it in the form of an asset.

3.4. **Free Parameters.** In order to clearly describe the mechanics of the Structure Economic Bloc, we make use of many free parameters.[13] The optimal values of these free parameters will be estimated using parameter auctions, as described in Section 4.2.

Note. Some of the free parameters have a significant impact on the potential profitability of engaging in certain operations. The fact that these parameters can be estimated directly via parameter auctions from those agents who stand to benefit from those very operations is both extremely surprising from a game theoretic perspective, but also exciting for the implications it has on the future of decentralized governance structures.

4. Value Measurement

By Definitions 3.2.4.2, value is nothing more than a function, ν, that maps a graph G onto $\mathbb{R}$. This causes two problems:

(i) Every ν_η is unique to its agent, η, which is why it is labeled by its agent index, η.
(ii) ν_η is practically unobservable by anyone other than η.

We see this as an information consolidation problem. The information we want—the characteristics of each $\nu \in \mathcal{N}$—is dispersed about $\mathcal{H}$ without any easy way of aggregating it.

[13] A complete list of free parameters is provided in Table 2

4.1. **Trade-Driven Market Estimators.** Such problems have historically been approached with market mechanisms that theoretically provide an incentive for agents to offer characteristic information about their valuation function to the marketplace that then attempts to consolidate it. In trade-driven marketplaces, consolidation is mainly limited to price. Price is meant to be an estimate for a characterization of $\mathcal{N}$. The set of trade driven-discovered prices are meant to indicate where in the state space of Θ_ε the currency-denominated trading volume would be maximized, conditioned on a particular G. In other words, trade-driven marketplaces are one particular *network parameter estimator* that: by providing a set of trading operations, $\breve{\mathcal{O}} \subset \mathcal{O}$, attempts to maximize

$$\sum_{a \in \mathcal{A}} \sum_{\substack{a' \in \mathcal{A} \\ a' \neq a}} \sum_{\eta \in \mathcal{H}} \sum_{\breve{o} \in \breve{\mathcal{O}}} \mathbb{E}\left[N_{\breve{o},\eta} | \hat{\pi}_{a,a'}\right] \hat{\pi}_{a,a'}, \tag{4}$$

with respect to $\hat{\Pi} = \{\hat{\pi}_{a,a'} \mid a, a' \in \mathcal{A} \wedge a \neq a'\}$. It is argued that $\hat{\Pi}$ is a *good* estimator of $\Pi^* = \{\pi^*_{a,a'} \mid a, a' \in \mathcal{A} \wedge a \neq a'\}$. Π^* is defined to maximize

$$\sum_{\eta \in \mathcal{H}} \sum_{\breve{o} \in \breve{\mathcal{O}}} \mathbb{E}\left[\nu_\eta(\breve{o}(N, G; \Theta^*_\varepsilon))\right], \tag{5}$$

where all prices in Θ^*_ε come from Π^*.

Unfortunately, some characteristics of trade-driven markets cause problems when used as network paramter estimators:

(i) Trading operations are conflated with parameter estimation operations.
(ii) The game-theoretic optimum for a parameter estimation agent creates a Type VII externality.
(iii) They estimate optima that are conditioned to Ψ^{I} rather than $\mathcal{M}$.
(iv) They do not function well without large amounts of liquidity, and are therefore capital-intensive or require the use of high leverage, which itself subjects the system to risk of instability.
(v) They reward speed to an unproductive degree, causing too much investment in low-latency technology that does not create value for the community.
(vi) They are only suited to estimating $\Pi \subset \Theta$ rather than the full set of parameters in Θ.

We propose an alternative parameter estimator that we call "parameter auctions" that avoids these problems.

4.2. **Simple Parameter Auctions.** Parameter auctions are a method for parameter estimation that is novel to the Structure Economic Bloc. A parameter auction provides a means for the agents in the economy to estimate the value of a network parameter in order to maximize the amount of value in the network with respect to the parameter. Parameter auctions do not suffer from the same negative externalities that trade-driven, market estimators do.

4.2.1. *Simple Parameter Auction for x.* Let us consider some generic parameter, x, whose value the Bloc wishes to estimate.

Proposition 3 (Non-indifference)**.** *Where $\mathbb{X}$ is the domain of x, we assume that*

$$(\exists \eta' \in \mathcal{H}) \wedge (\exists x', x'' \in \mathbb{X}) \mid \nu_{\eta'}(x') \neq \nu_{\eta'}(x'').$$

Definition 4.2.1.1. Let t_0 be the launch time of the Structure Economic Bloc.

Definition 4.2.1.2. Let $\Delta t_a > 0$ be the amount of time between updates to x.

Definition 4.2.1.3. Let $t_i = t_0 + i\Delta t_a, i \in \mathbb{N}$.

Definition 4.2.1.4. Let the value of X at time t, $X(t)$, be the right semi-continuous, partial function:

$$X(t) = \begin{cases} \text{undefined} & t < t_0 \\ X(t_i) & t_i \leq t < t_{i+1}. \end{cases}$$

Definition 4.2.1.5. Let X_i be an abbreviation for $X(t_i)$.

The parameter auction during (t_{i-1}, t_i) offers participants the opportunity to contingently "buy" the value of X_i by sending the auction house a fully funded, blind bid. The bid, $b_{\eta i}$, of agent, η, is funded with a stake, $\psi_{a\eta i} \in \mathbb{R}^+$. $b_{\eta i}$, may be any function $b_{\eta i} : \mathbb{X} \to [0, \psi_{a\eta i}]$. $b_{\eta i}(x)$ represents the amount that agent η will pay to the Bloc[14] if $X_i = x$.

Definition 4.2.1.6. Let $\hat{\mathcal{H}}_i$ be the set of all agents who submit bids to the parameter auction during (t_{i-1}, t_i).

Definition 4.2.1.7 (Aggregated Bids).

$$B_i = \sum_{\eta \in \hat{\mathcal{H}}_i} b_{\eta i}$$

Estimator 1 (Simple Parameter Auction)**.** *The Parameter Auction estimates the optimal value of X at time t_i according to:*

$$X_i = \begin{cases} x_{i-1}, & |\hat{\mathcal{H}}_i| = 0 \\ \operatorname{argmax}_{\mathbb{X}} B_i, & |\operatorname{argmax}_{\mathbb{X}} B_i| = 1 \\ \operatorname{argmin}_{\mathbb{X}}\{|x_{i-1} - \operatorname{argmax}_{\mathbb{X}} B_i|\}, & |\operatorname{argmax}_{\mathbb{X}} B_i| > 1 \end{cases}$$

Claim 1. An agent, η, maximizes ν_η when he submits a bid that satisfies

$$b_{\eta i}(x) = \nu_\eta(x \wedge \psi_{a\eta} - b_{\eta i}(x)).$$

Id est, the agent does best when he offers his honest valuation function with respect to the estimated parameter, x, and the payment amount, $\psi_{a\eta}$.

Such an auction should provide at least as much value to $\hat{\mathcal{H}}$ as any other parameter estimation method of which we are aware.

5. Farming

5.1. **Rights.** Members of the Structure Economic Bloc have the *exclusive* right to farm `STXR`. Farming consists of creating value within the Structure Economic Bloc. What constitutes the *creation of value* is a decision reserved for Governance. The Structure Economic Bloc rewards a farmer for doing valuable work by minting new `STXR` and crediting it to the farmer's wallet address.

[14] Which will subsequently send the payment to an address from which it cannot be removed.

5.2. **Activities.** Farming is any non-conservative operation with $\Delta v > 0$. In the Structure Economic Bloc, farming operations will initially consist of the following farming subtypes:

Definition 5.2.0.1 (Trading & Price Discovery). Define trading to be any $\tilde{o}$ whose effect $\tilde{o} : G_k \mapsto G_{k+1}$ is such that

$$\begin{aligned} \mathcal{E}_{G_k} &= \mathcal{E}_{G_{k+1}} \\ \mathcal{A}_{G_k} &= \mathcal{A}_{G_{k+1}} \\ \mathcal{O}_k &= \mathcal{O}_{k+1} \\ \mathcal{H}_k &= \mathcal{H}_{k+1} \\ &\text{but} \\ \Psi^{\text{II}}_{G_k} &\neq \Psi^{\text{II}}_{G_{k+1}}. \end{aligned}$$

Definition 5.2.0.2 (Connecting). Define connecting to be any $\tilde{o}$ whose effect $\tilde{o} : G_k \mapsto G_{k+1}$ is such that $|\mathcal{E}_{G_k}| < |\mathcal{E}_{G_{k+1}}|$.

Definition 5.2.0.3 (Importation). Define importation to be any $\tilde{o}$ whose effect $\tilde{o} : G_k \mapsto G_{k+1}$ is such that $|\mathcal{A}_{G_k}| < |\mathcal{A}_{G_{k+1}}|$.

Definition 5.2.0.4 (Facilitation). Define facilitation to be any $\tilde{o}$ whose effect $\tilde{o} : G_k \mapsto G_{k+1}$ is such that $|\mathcal{O}_k| < |\mathcal{O}_{k+1}|$.

Definition 5.2.0.5 (Recruiting). Define recruiting to be any $\tilde{o}$ whose effect $\tilde{o} : G_k \mapsto G_{k+1}$ is such that $|\mathcal{H}_k| < |\mathcal{H}_{k+1}|$.

Definition 5.2.0.6 (Stockpiling). Define stockpiling to be any $\tilde{o}$ whose effect $\tilde{o} : G_k \mapsto G_{k+1}$ is such that

$$\sum_{a \in \mathcal{A}_{G_k}} \psi_a \pi_{aa'}(G_k) < \sum_{a \in \mathcal{A}_{G_{k+1}}} \psi_a \pi_{aa'}(G_k),$$

where a' is a currency and $a \neq a'$, and

$$\pi_{aa'}(G) = \begin{cases} \text{med}\{\pi_{aa'}\}, & \pi_{aa'} \in \bigcup_{\Theta_\varepsilon \in \mathcal{E}_{G_k}} \Theta_\varepsilon \\ 0, & \bigcup_{\Theta_\varepsilon \in \mathcal{E}_{G_k}} \Theta_\varepsilon = \emptyset, \end{cases}$$

where med$\{\cdot\}$ indicates the median of the set.

Definition 5.2.0.7 (Staking). Define staking of asset a for amount ζ from $[t, t+\Delta t_\zeta]$ to be any $\tilde{o}$ whose effect guarantees $\psi_a > \zeta$, $\forall t \in [t, t+\Delta t_\zeta]$.

6. Minting Rate Control

It is self-evident that in order to maximize the price return and price stability of `STXR/USD`, the minting rate of `STXR` must be controlled. For such an objective, the Structure Economic Bloc uses a control mechanism inspired by the difficulty algorithm of the Bitcoin Network[1].

6.1. **Bitcoin Control Mechanism.** Recall that in the Bitcoin Network, the difficulty d_i for period i is determined as follows:

$$d_i = d_{i-1} \max \left[\min \left(\frac{2016 t^*}{t_e}, 4 \right), \frac{1}{4} \right] \tag{6}$$

where t^* is the target block mining rate and $2016/t_e$ is the empirical block mining rate in the most-recent 2016 blocks[2]. The difficulty algorithm has the following property:

Property 6.1. Increasing block mining rates cause an increase in the block mining difficulty, up to a cap; and decreasing block mining rates cause a decrease in block mining difficulty, down to a floor. Consequently,

(i) The deviation of the block mining rate from its target provides negative feedback jointly to (a) the bitcoin minting rate, and (b) transaction throughput.
(ii) Conditional on block size, the mining rate, transaction throughput, and minting rate of the Bitcoin Network are all jointly coupled.

6.2. **Structure Economic Bloc Control Mechanism.** Although there are similarities, the Structure Economic Bloc has different requirements and objectives than the Bitcoin Network. As a virtual economic zone, the Structure Economic Bloc's primary concerns are as set forth in Section 2.2. Chief among them is the price return of `STXR/USD`, which we will deal with now. We propose the following algorithmic minting rate measure, followed by an independent mechanism designed to control it.

6.2.1. *Measure Formulation.*

Definition 6.2.1.1. Let $\pi(t)$ be the right semi-continuous price of `STXR/USD` at time t.

Definition 6.2.1.2. Let $0 < \Delta t_f \leq \Delta t_s$ both be intervals of time.

Definition 6.2.1.3. Let $\overline{\pi}(t)$ be the time-weighted average price (TWAP) over time period $[t - \Delta t, t)$ as defined by the Riemann-Stieltjes integral:

$$\overline{\pi}(t) = \frac{1}{\Delta t_f} \int_{t-\Delta t_f}^{t} d\pi(\tau).$$

Definition 6.2.1.4. Let ρ^* be the target price return of `STXR/USD` over Δt_s.

Definition 6.2.1.5. Let $\overline{\rho}(t)$ be the continuously compounded, empirical price return of `STXR/USD` as calculated by:

$$\overline{\rho}(t) = \frac{\Delta t_s}{\Delta t_f} \ln \left(\frac{\overline{\pi}(t)}{\overline{\pi}(t - t_f)} \right)$$

Minting Rate Measure. *Let $\mu(t)$ be the measure defined by:*

$$\mu(t) = \frac{\overline{\rho}(t) - \rho^*}{\sigma}, \quad \sigma \in \mathbb{R}^+. \tag{7}$$

The use of $\mu(t)$ to measure minting rate implies the following principle:

Principle 1. *The value of controlling the rate of minting, or any Bloc measure, derives exclusively from its power to effectuate the goals of the Structure Economic Bloc.*

6.2.2. *Control Formulation.*

Definition 6.2.2.1 (Aggregate Adjustment Coefficient). Let the aggregate adjustment coefficient, $\delta(t)$, be defined as:

$$\delta(t) = \max\left[\min\left(\mu(t), \overline{\delta}\right), \underline{\delta}\right],$$

for $\overline{\delta}, \underline{\delta} \in \mathbb{R}^+$. Notice the similarity to Eq.(6).

Definition 6.2.2.2. Let Δt_i be a particular time interval $(t_i - \Delta t_f, t_i]$ named for its index $i \in \mathbb{N}$. Additionally, let $t_{i+1} = t_i + \Delta t_f, \forall i \in \mathbb{N}$.

Definition 6.2.2.3. Let $\mathcal{O}(t)$ be the set of all farming activities offered in the Structure Economic Bloc at time t, and let $\mathcal{O}(\Delta t_i) = \bigcup_{t \in \Delta t_i} \mathcal{O}(t)$.

Definition 6.2.2.4. Let $N_{\tilde{o},i} \in \mathbb{R}^+$ be a random variable representing the total "volume" of activity that $\tilde{o} \in \mathcal{O}(\Delta t_i)$ is performed during the time period Δt_i.

Definition 6.2.2.5. Let $X_{\tilde{o},i} \in \mathbb{R}$ be a random variable representing the price paid to the farmer for performing activity $\tilde{o} \in \mathcal{O}(\Delta t_i)$ during the time period Δt_i. The price, $X_{\tilde{o},i}$, is `STXR`-denominated; and the Structure Economic Bloc funds this payment by minting the needed quantity of `STXR` and crediting it the farmer's wallet.

Definition 6.2.2.6. The total quantity of `STXR` minted and assigned by the Structure Economic Bloc during the period Δt_i is then:

$$q(\Delta t_i) = \sum_{\tilde{o} \in \mathcal{O}(\Delta t_i)} N_{\tilde{o},i} X_{\tilde{o},i}.$$

Minting Control. *At times $\{t_i\}_{i \in \mathbb{N}}$, the Structure Economic Bloc members have the right to set the price of all activities, $\{x_{\tilde{o},i}\}_{\tilde{o} \in \mathcal{O}(t_i)}$, in order that:*

$$\mathbb{E}\left[\sum_{\tilde{o} \in \mathcal{O}(\Delta t_i)} N_{\tilde{o},i} x_{\tilde{o},i}\right] = \delta(t_i) q(\Delta t_i). \tag{8}$$

Note 1. $X_{\tilde{o},i}$ and $x_{\tilde{o},i}$ derive from the same ontology. Recall that, as is customary in probability, a random variable is denoted with an uppercase letter in order to represent to the random process *itself*—*id est*, when the outcome of the process is still unknown—while a lowercase letter is used to represent the *realization* of the random process—*id est*, the specific value generated by the random process. It is deliberate and important that Definition 6.2.2.6 uses $X_{\tilde{o},i}$, whereas Minting Control uses $x_{\tilde{o},i}$.

Note 2. Although Eq. (8) may appear as though further simplification is possible, to wit the incorporation of the expectation into the summand, in fact, this would be incorrect. Unfortunately, at this level of analysis, we cannot commute expectation with summation because the summands may not be independent. Indeed, we believe that they are not. This becomes clear when considering the relationship between X and N. In entertaining the proposition that the realized value x may correlate with the expectation of N, one may appreciate the need for such caution.

7. Farm Shares

A farm share is a share of future farming yields from the Structure Economic Bloc. A farm share is purchased from the Structure Economic Bloc directly. It entitles its purchaser to a percentage, β, of the `STXR` that are farmed in a given period, Δt_β. The money that the Structure Economic Bloc receives for the farm share sale funds the Treasury (Section 8.2). Farm shares provide a way for members to contribute value to the Structure Economic Bloc in the form of capital rather than through other farming activities for which they may have limited abilities. Additionally, farm shares offer the Structure Economic Bloc a means of financing itself for other capital-intensive endeavors, just as sovereigns do when they sell bonds denominated in their own currency. The difference here is that the Structure Economic Bloc is a wholly-owned, fully decentralized, global economic zone for which such financing decisions occur by way of an internet-first, skin-in-the-game, direct democracy.

8. Decentralized Autonomous Organization

The Structure Economic Bloc is structured as a DAO. The DAO consists of

- Bloc Members,
- Farm Share members (Section 7),
- the Treasury (Section 8.2),
- and the Foundation (Section 8.3).

8.1. **Bloc Membership.**

An individual must pay a membership fee in order to become a member of the Structure Economic Bloc. The amount of the membership, ϕ_m, be will be determined by Governance, but will initially be set to $\phi_m = 1$ `STXR`. The fee shall be paid to a Structure Economic Bloc-designated contract address on a participating blockchain for which there is no possibility of withdrawal. All `STXR` that are paid as a fee are therefore permanently taken out of circulation. Once paid, the individual will be eligible to participate in the Structure Economic Bloc as a member.

8.2. **Treasury.**

The Treasury can be thought of as a non-sovereign wealth fund. It consists of the funds paid into the Structure Economic Bloc from farm shares or other financing vehicles that benefit the Bloc as a whole, rather than a specific set of parties within it, and it is completely managed by the DAO. The money that accumulates in the Treasury can be used for whatever legal purpose the DAO wishes.

Many digital asset exchanges employ a "buy and burn" mechanism in order to inject value into their platform token. We believe the Structure Economic Bloc's DAO and Treasury represents the abstraction of this concept that is more general and democratic.

8.3. **Foundation.**

The Foundation is a "real world" non-profit entity whose charter is to carry out the objectives of the Structure Economic Bloc: to further the wealth and well-being of the Bloc. The Foundation needs to exist in order to carry out those activities that cannot yet be executed purely through smart contracts, blockchain, or other digital means. The Foundation will be funded by the payment of a fraction, ϕ_f, of newly-minted `STXR`, which will initially be set to 1%. Agents of the Foundation are elected by the DAO and funded by the Treasury.

8.4. **Governance.** The DAO is governed by the votes of its members. There are three kinds of voting:

8.4.1. *Incentivized Voting.* Incentivized voting is a vote whose participation is incentivized by providing its participants with `STXR` rewards. This voting mechanism will be reserved for decisions that may not have enough participation in order to be useful or safe were it not for the incentive, although this will not likely occur frequently.

8.4.2. *Entitlement Voting.* Entitlement voting is a vote that all `STXR` holders may participate in. In an entitlement vote, anyone who possesses `STXR` is welcome to vote; however, there is no direct compensation for such participation.

8.4.3. *Expenditure Voting.* Expenditure voting is a vote that requires the payment of a fee in order to participate. An `STXR` holder can participate in an expenditure vote only if he spends his `STXR` (which is then subsequently burned) in order to cast his vote. Expenditure voting decreases the supply of `STXR` and strongly incentivizes participants to vote in favor of the direction that most-increases the value of their remaining `STXR`. Additionally, this voting mechanism disincentivizes participation from low-information and non-marginal voters, which may be advantageous for the Structure Economic Bloc when faced with decisions whose effect size is large.

Expenditure voting is used for any member-sponsored motions whose effect on the Structure Economic Bloc cannot be easily reversed. There are too many such cases to enumerate them all, but one example could be an amendment to the very mechanics of Governance itself. For more details on how expenditure voting will be employed, see Section 4.2

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TABLE 2. Free Parameters in the Structure Economic Bloc.

Parameter	**Defined In**	**Initial Value**
Δt_f	6.2.1.2	1 month
Δt_s	6.2.1.2	1 year
ρ^*	6.2.1.4	100%
σ	Eq.(7)	1
$\underline{\delta}$	6.2.2.1	-0.5
$\overline{\delta}$	6.2.2.1	2.5
$\mathcal{O}(t)$	6.2.2.3	As described in Section 5
ϕ_m	Section 8.1	1 `STXR`
ϕ_f	Section 8.3	1%
β	Section 7	1%
Δt_β	Section 7	1 year