The Utilitarian Economy

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Abstract

This paper sets out an economic construct that might increase collective utility in the economy. Just like in classic economies, a democratic process will underpin its definition. From an initial laissez-faire style economy, participants can submit transactions that will have their externality value estimated and settled among the respective parties. With a system in place of carefully designed incentives and an estimation dispute-settling committee, it is argued that for sufficiently low transaction costs these institutional arrangements might contain advantages over standard governmental architectures.

1 Tragedy of the Commons

The tragedy of the commons is a problem that seems to be rooted in society. Although its effects have clearly been mitigated when addressed, they are not always eradicated. In current times, one could argue that problems that are labelled correspondingly or contain certain similarities are growing more daunting than ever. A few of these examples would be climate warming, overfishing [1] and, recently, the uneven distribution of vaccines [2].

2 Externalities

In contemporary capitalist economies, participants' behavioural functions are mainly based on personal gain. As Adam Smith notoriously asserted 'It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest', although he also acknowledged that people sometimes behave altruistically [3].

For this reason, situations arise where collectively suboptimal outcomes are reached (if no government intervention takes place) because costs to others are not usually adequately considered by economic participants, as is the case for the examples provided in the introduction. This is usually further explained by modelling the situation at hand and expressing it in the form of an economic game, in which players are the participants and different actions lead to different outcomes.

For the games modelled, an outcome called the "prisoners' dilemma" is often used as an example to display what can lead to such 'tragedies'. Players in these games base their choice on the maximum expected utility to be gained. As mentioned in the previous paragraph, these values for most people are predominantly based on personal economic benefits and do not sufficiently factor in costs to others, so-called 'externalities'. When people then

optimise their personal utility functions depending on how other players are expected to behave in these games, there is usually little incentive to behave collectively optimally.

3   Governmental Solution

In current times, governments can be said to play a prominent role in the process of transferring these externalities between respective parties so that collectively better outcomes are reached. Namely, if these costs are transferred, people will behave as to more often prevent incurring them, thus behaving collectively for the better. Governments usually do this by taxing individuals or corporations that produce negative externalities and subsidizing parties that produce the opposite kind, positive externalities.

For the most part, projects or institutions that the free market on its own would not be able to organise are also part of governments' activities, which can be seen as the government producing positive externalities that are ultimately being paid for it in the form of taxes, that are generally collected from everybody in the economy, usually irrespective of the extent to which these individuals profit from these undertakings. Projects and institutions like these could fall into the categories of education, healthcare, infrastructure and so on.

4   Governmental Imperfections

To reveal a first imperfection of governments relevant to this paper, consider a society in which every individual that is part of the electorate votes for their preferred candidate in an election, which is nothing special. People vote to maximise their personal utility function, which can also consist of the interest of others. Therefore, assuming they only get to cast one vote per election, they will vote for the candidate they think will maximise their utility function when given their vote, by definition.

Although some strategic voting might exist (for example when the preferred candidate is unlikely to be elected at all) and not everybody will have a candidate that perfectly matches them, the candidates that are elected will only roughly behave as to maximise the utility function of the electorate because the votes they received were from people who found they best matched their personal utility functions and candidates who would focus to benefit only a small group of people will not generate a large group of supporters. Namely, assuming that all personal utility functions are at least slightly unique, one would have to have at least the same number of candidates running for election as the number of people in the electorate, which would entail clear impracticalities.

For these reasons, a government elected correspondingly will, in theory, implement policies that are not completely in sync with the collective utility function, but that will be based on a rough interpretation thereof. Therefore, the utilitarian costs or benefits assigned to certain externalities are more unlikely to correspond to the actual value, which, in turn, means that collectively more desirable outcomes in economic games are not always achievable to an extent that would be possible with perfectly defined externalities.

As the second example necessary for the core analysis in this paper, notice that there is hardly any competition in governmental bodies (some companies may be state-owned).

In pure free markets, competition leads to greater extents of efficiency. On the contrary, governments are not continuously exposed to this competitive system which means that performance is not directly related to the probability of organisational survival. This means that there is no natural selection-like process at play to optimise efficiency. Thus, it is unlikely that the incentives for the government are configured to ensure optimal performance, meaning governmental behaviour is unlikely to comply optimally with its definition of collective utility (which is indirectly equivalent to performance) explained in the previous paragraph.

5   Substitutive System

In no way this paper argues that governments are disadvantageous to society, but just that other non-trivial designs might lead to more optimal societal outcomes. The economic architecture described in this paper will be explained by hypothetically starting out with a free market economy and arguing how certain processes and institutions can be used to create an economy that might be collectively more efficient than contemporary ones while using the imperfections laid out in the previous section to compare it with the standard alternative.

Thus, suppose one starts out in a free-market economy. If one could change the utility functions of people, one would be able to change the outcomes of economic games, possibly for the better, collectively. For example, to prevent situations like the prisoners' dilemma from arising. However, this would require influencing peoples' cognitive processes, which determine people's utility functions. Therefore, this seems infeasible and probably to many unethical (perhaps even seems as brainwashing). What remains would be to change the rules of the games played in the economy.

Free-market economies are underpinned by the principle that the more some good or service is worth to some economic participant, the more monetary units they are willing to transfer to the respective provider thereof. Effectively, interpretations of this simple system have proven to entail substantial economic gains and consequently have been widely adopted [4]. Nevertheless, these transactions largely fail to factor in how much other people want that transaction to take place. In economics, like mentioned before, situations like these are referred to as those that contain externalities.

What if one could magically change the monetary value of transactions so that the units to be transferred can be benchmarked against other transactions in the economy to display the relative collective keenness on the transaction taking place? In other words, one would make it so that to what extent all people in the economy want some transaction to take place determines the number of monetary units to be transferred to the person providing the good or service.

If one were to reshape personal incentives like this, thus conforming to the utilitarian gain of all those in the economy, participants of the economy would behave largely directly to maximise collective utility as this roughly maximises their personal utility, too. Notice that this theory has many similarities to the Coase theorem of perfectly defined property rights [5].

Implementing this in practice is not so simple, though. For example, firstly, one would have to have a system in place to adjust the value of transactions in the economy. One solution

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would be to have all transactions be digital so that the outstanding externality amount for all transactions can be settled afterwards. Namely, if one would do it beforehand, one would have to define the externality amount of all possible transactions in the economy, which would clearly be impossible. If one would settle them in cash, other practical constraints would arise like the impossibility of negative balances.

Then, it follows that one would have to devise a system to determine the value of the externalities to be used to adjust transaction sizes. Regarding this challenge, a solution might seem to have the externality size of every single transaction that happened be democratically defined, but the sheer burden of this work means that this is impractical. Therefore, a small random group of people could be selected proportional to the projected externality size to then democratically agree upon an estimation of the externality size of a single transaction or a group of transactions (one that contains the same externality, proportionally).

Still, disagreements about the externality valuation can arise as not the whole of democracy is used to estimate its value for the relevant transaction or group of transactions. If left alone, the respective externality valuation will not be defined and can consequently not be used in the adjustment of transactions. One could have this dispute settled by a democratic vote, but there could simply be too many of these referendums and usually no incentive to vote thoughtfully (or at all) if the externality settlement does not involve oneself.

Therefore, there should be a jural body in place that is tasked with settling these disputes. Logically, this committee should be elected democratically to mirror the utilitarian judgements society would make as closely as possible. Notice that this leads to the same imperfection laid out as the first example in the previous section, but decreases the transaction costs associated with the social turbulence that goes hand in hand with disagreements on certain externality estimations. More on this is explained later, but for now, it is semi-arbitrarily assumed that this trade-off is worth it as it seems hard to argue for one option or the other without any evidence.

The members of this committee should be required to vote democratically themselves on their preference. In order to have this board manage the workload, transactions can be categorised as would committee members to split democratic votes to be held in separate departments so that members will not have to vote for every transaction dispute.

6 Aligning Incentives

6.1 Estimating Externalities

The idea that has been established so far does not give a reason for randomly selected individuals to engage with the estimation process. Paying them a fixed sum for it would not incentivize them to put more effort in the process, either. Additionally, it has not been explained yet how transactions are submitted to have the externalities be estimated semi-democratically.

Suppose the following solution: one would get rewarded proportionally to the absolute value of the externality (thus always positive) when having their estimation be approved. Furthermore, a group that submits estimates will be formed separately from the group that

votes for their preferred estimate so that no tactical voting can take place. One person will start out with the submission of a filled-in contract template after which a random group of others will be prompted with the option to submit an estimate, too. This process is random and anonymous so that the probability is minimised that conspiring groups will use certain estimates in their self-interest.

This randomly selected group will then digitally be provided with all the sources the first person used so no inequality in information can exist. They would also be able to use other sources as an incomplete or biased set might have been used by the initiator of the process. Next, all filled-in templates are submitted to a digital system that consequently allocates these to a random group of people in the economy to have them vote for the estimate they think most closely mimics the utilitarian mindset of their society.

Why they would actually behave this way would be an appropriate question at this point. Note, however, that rewarding voters proportional to the externality size of the estimation that ends up with the most votes does the job, on one condition: in the future, they will be punished proportionally for different estimations of the externality size of the same transaction (as they overwrite each other and can not get away with a quick profit). This will hold for the successful estimator, too.

6.2   Estimation Committee

Still, situations might arise where two or more parties keep submitting new estimation contracts of the same transaction or group of transactions, which could inefficiently run indefinitely and could lead to social turbulence. Additionally, there might be malicious estimators who do not adhere to the economy's estimation standards (like providing false data). In these types of cases, there should be a committee that itself sets up the estimation standards and can make adjustments to the digital estimation system. As mentioned before, this comes at the expense of the first governmental imperfection laid out a few sections before this one. Without an organisation like this in place, though, for logical reasons inefficiencies and disorder might abound. Therefore, a concept called the 'Estimation Committee' would be the jural body that keeps the estimation process in check.

In each category department, members will settle their respective queries by democratic vote. The number of categories and their definition would be determined by the Committee Head Department. This department will also be staffed with the determination of the proportion sizes for successful estimators and voters and Committee wages. Like in most government-type bodies, Committee-determined wages (and social status) will be the reward to such positions. Verdicts in each category department could include the reversal of transactions, adjustments thereof or (temporary) banning of individuals from participating in the externality estimation process. Notice that this means that all externality estimations will be done so that the probability of them being reversed by the Estimation Committee is minimized (the incentives behind this process will later be shown in more detail). This, in turn, means that people estimating the externalities will try to do this so that it corresponds to the ethical framework the Estimation Committee has set up.

Logically, these incentives are not optimally aligned with performance but a semi-governmental board is required to deal with the economic exploits that would otherwise exist. It is just the

case that large inefficiencies in the externality estimation processes can be expected without it. And after all, if the people are not happy with the committee members' performance (perhaps as a result of the imperfectly aligned incentives), they will simply elect others the following election like would be the case for regular governments (its governance period to be determined initially and subject to be changed by the Committee Head Department). In a system where a large number of individuals have to be elected, the formation of 'political' parties will be imminent as the electorate will then be able to form a distinct image of most participants.

To incentivize people not involved in a dispute or fraudulent estimation process to look for these economic imperfections, the absolute value of a proportion of the projected economic damages will be rewarded in case of a verdict that entails changes to the situation at hand. Otherwise, to reduce the work burden of the Committee (preventing spam), the accuser will be punished proportionally to the economic damages otherwise acknowledged.

When reading this section, one should keep in mind that other, possibly more efficient political structures of the Estimation Committee might exist. Therefore, its proposed architecture and political workings should be assessed critically.

6.3   Transaction Costs

As the attentive reader might have noticed already, the part this economic system solves in relation to the governmental imperfections laid out a few sections earlier, is that there will be a system in place to foster the efficiencies of a bigger role of the market in the projects and institutions or transfers of externalities that governments would usually take care of. However, one might have also realised that larger transaction costs might well arise in the proposed economic system because the Estimation Committee will have to settle disputes about the externality estimation of participants in the economy.

Usually, civil servants part of the government will be staffed with implementing policies after considering the effects to society, possibly by an analysis of the associated externalities. This would be roughly equivalent to the transaction costs incurred by estimators in this paper's proposed architecture although this process might not always be as intensive or run semi-democratically so that principal-agent problems might occur more often and to a greater extent, although transaction costs are reduced.

However, even while disputes might also arise within governmental departments performing analysis before policy implementation, it might be the case that these are resolved, again, in a more informal process so that transaction costs are reduced but losses in emergent collective efficiency arise.

Just like in regular governments, information is crucial for the estimation of the externality values of certain transactions to the parties affected. As will be argued later, providing information to the market might be set to be required by law, also in the Utilitarian Economy.

7 Proposed Economic Architecture

To clarify the suggested economic structure, this section will provide a graphical interpretation of the suggested economic structure. Below, the icons to be used in these images are displayed and labelled.
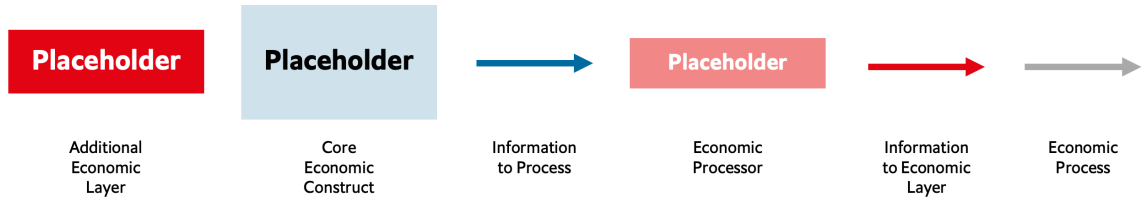

Figure 1: Icons

In its simplest form, the economy architecture can be displayed as is done so below. The core economic construct is a Laissez-Faire economy, in which participants' externality estimations (shown by the arrow on the left) are used for the utilitarian adjustment of transactions. As shown by the arrow on the right, participants indirectly (via the Estimation Committee) make formal adjustments to estimations and the estimation system itself. In short, a system of utilitarian adjustment operates on top of a free-market economy, whose participants closely control this upper economic construct.

Figure 2: Economy Architecture (Compact)

One level of abstraction lower, provided below is another (labelled) graphical representation of the economy architecture suggested. At **1**, estimation contracts by individuals are submitted to a digital decentralized allocator that will then, at **2**, allow a random selection of others to add their estimations, anonymously and without being able to see any of the others' processes. This could run on a blockchain (for example on the Ethereum Mainnet) so nobody in (or no hacker outside) the Estimation Committee is in a position to single-handedly make non-reversible changes to the economy not initially specified (because of blockchain's immutability). A regular well-protected database might also be used if the blockchain is incapable of processing transactions with acceptable speeds (as will also be explained later). Next, a randomly selected group will be able to vote on their preference out of the submitted estimations.
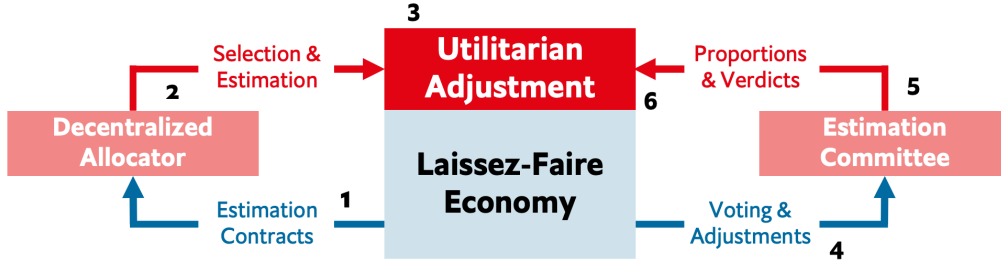
Figure 3: Economy Architecture (Elaborate)

At **3**, the estimation with the most votes (or a random one chosen out of those with an equal number of votes) will be used for the utilitarian transaction adjustment and the respective estimator and its voters will be rewarded proportionally to the absolute externality amount (the respective proportions to be determined by the Estimation Committee). A (relatively higher) proportion of the negative absolute difference of the new estimated externality value and the respective previous one will be settled among all previous successful estimators and voters. This is so that a series of inaccurate estimations will not be left unpunished.

One should not be misled to believe that no fine balance can be struck between these proportion values. If one has estimated some negative externality to be 10 parts of the transaction size and a new estimation using new information estimates it at 8 parts, with any initial reward proportion p and a punishment proportion q the estimator would have probably still made a profit for reasonable levels of q: $10p - (10 - 8)q = 10p - 2q$ (where $q > 0 \land p > 0$). If the next estimation would be 9 parts of the estimation size, this person would have made (or lost): $10p - (10 - 9)q = 10p - q$. This also means the respective cash inflow relating to the new estimation will be $10p - q - (10p - 2q) = q > 0$.

Again, these proportions are experimented with and determined by the Head Department of the Estimation Committee, to be set at levels they think properly encourage careful externality estimation but do not deter people from the process. The reward payments or punishments are suggested to be transferred from or to, respectively, the electorate, as the estimators and voters are (in hopefully most scenarios) contributing to the workings of the Utilitarian Economy that itself causes positive externalities. The settlement of these proportions is mathematically a simple process as is shown in the previous paragraph (because $p < q$ consider that in some cases all estimators and voters together will have paid more than received, $\lim_{\epsilon \downarrow 0} \epsilon p - q + p = p - q < 0$). Note that for computational burden-related reasons at some time the successful estimators and voters far down the line should not still be impacted by new estimations.

At **4**, the electorate (to be initially determined before the Head Department can optionally redefine it) votes for its preferred members of the Estimation Committee and submits queries relating to injustices in the externality estimation process. At **5**, proportions and other parameters relevant in the estimation and accusation process are configured (initially, and otherwise if there is a vote in the Head Department to adjust them). Additionally, the Committee makes judgements, processing queries submitted by individuals. Finally, at **6** these decisions will take effect and impact rewards, punishments and privileges relating to the externality estimation process.

8 The Estimation Template

8.1 Overview

As mentioned before, an estimation template should be defined and configured by the Estimation Committee to be used by all estimators in the economy. Therefore, a solid design will be crucial to foster efficiencies of the Utilitarian Economy. Core features suggested that it should facilitate are: understandability, comparability and accuracy. This will ensure that as many of the economy's participants as possible will be able to estimate and vote with confidence without spending too much time on these activities.

Although at the beginning of transferring to the Utilitarian Economy it is expected that large inefficiencies in the estimation process will exist, once a large number of contracts has been accepted and revised, more evidence and know-how will have been accumulated for most widespread and prominent economic transactions. This means that the cost of estimation can be expected to fall gradually. Of course, experiments need to be conducted to see how big these costs are in practice and behave over time. What follows will be the sections suggested to be included in the estimation form template.

8.2 Sources

Firstly, sources are crucial to back up calculations and explanations. What will be relevant will have to be determined by the Estimation Committee, but evidence like statistics from surveys, natural measurements and finances are suggested to be required in the form. As mentioned before, the sources of the person that submits the transaction to have their externality estimated will be shared with the randomly selected group of estimators to avoid asymmetric information. It should of course be critically evaluated by voters if sources are used correctly and if some important ones are left out.

8.3 Simple Calculation

From these sources, the estimator will have to provide a simple calculation supporting the final externality estimation. It is emphasized, again, that the Estimation Committee will have to require this calculation to follow simple rules so most randomly selected voters can understand it. A standardised format is also recommended as this would entail efficiency gains over time.

8.4 Explanation

If proven helpful, an explanation field can also be required in which estimators will have to explain their calculation, how they used their sources for it and why they used the sources that they did. This is just a suggestion, other rules are also possible and should be experimented with.

9 Mathematical Translation

This section will support the explanations in the previous sections by translating the ideas into mathematical terms. No formal proofs will be given supported by data, but some light

frameworks will be set up that can be worked with in future research or used to devise relevant experiments.

First, a classic economic game with a collectively suboptimal outcome (in free-market economies) will be solved with the principles of the Utilitarian Economy. Secondly, a more formal mathematical definition of the Utilitarian Economy and its projected workings will be provided. In both of these sections, transaction costs will be disregarded. In the third example, the Utilitarian Economy will be compared with a regular economy containing a standard government. Here, transaction costs and incentives disparities are analysed at a fairly high level of abstraction.

9.1 Prisoners' Dilemma

Suppose one is provided with the classic prisoners' dilemma, as displayed below. The following is given:

- The set of players is defined as $P = \{p_1, p_2\}$.

- The action set is defined as $A = \{a_1, a_2\}$.

- Both players have a profit function part of the set defined as $\Pi = \{\pi_1(a_j, a_k), \pi_2(a_j, a_k)\}$.

- $\pi_i(a_j, a_k) \in \{\alpha, \beta, \gamma, \delta\}$ for $(i \wedge j \wedge k) \in \{1, 2\}$.

- The game will be sequential and run indefinitely.

- The game matrix is given below, and as is the case for games modelled after the Prisoners' Dilemma, the personal payoffs correspond to the following combination of inequalities: $\alpha < \beta$, $\gamma < \delta$ and $max(\pi_1(a_j, a_k) + \pi_2(a_j, a_k)) \neq 2\delta$. The left payoffs will relate to p_1, the right ones to p_2.

Game		p_2	
		a_1	a_2
p_1	a_1	α, α	γ, β
	a_2	β, γ	δ, δ

Table 1: Prisoners' Dilemma

In order to continue the analysis to compare the outcome between that in regular economies and in the utilitarian economy, it is important to highlight the distinction here between profit and payoff. In this game, the payoffs are in terms of monetary rewards to actions. If one would use utility here, one would change the payoff values when explaining what would happen in the Utilitarian Economy which might be confusing. Nevertheless, all other things equal, most players of this game would probably prefer outcomes with higher payoffs, and it is assumed that proportional changes would go with proportional preference changes.

In this game, there are two scenarios:

1. $\gamma + \beta > 2\alpha$

2. $\gamma + \beta < 2\alpha$

Unsurprisingly, for both cases (in classic free-market economies) the Nash equilibrium will be reached where both players play the action a_2, yielding the suboptimal outcome of (δ, δ).

Now, suppose the first scenario. If one of the two players would change their action to a_1, they would relatively lose $\delta - \gamma$. However, as their action contains the positive externality of $\beta - \gamma$ (to be transferred from the other player's account), they will improve on their allocation (because $\gamma + \beta > 2\alpha$ and $max(\pi_1(a_j, a_k) + \pi_2(a_j, a_k)) \neq 2\delta$ so that $-(\delta - \gamma) + \beta - \delta > 0 \Rightarrow \gamma + \beta > 2\delta$ which holds). The collectively maximum payoff is reached and there is no reason for any of the players to deviate because the collective payoff can not be increased.

For the second scenario, one might imagine that for similar reasons the equilibrium of (α, α) will be reached, after having the outcome change from its initial (δ, δ) allocation to the (β, γ) or (γ, β) one, but this will only happen if $\gamma + \beta > 2\delta$. If that is not the case, initially it would seem that the equilibrium of (δ, δ) will stand as deviating will not increase their final payoff. Namely, if one player were to play a_1, he would lose payoff because of the lower collective payoff. One might think that this will not matter as (α, α) will subsequently be reached (the other player can increase collective payoff this way), but the increase in payoff from γ to α will be transferred to the other player as an externality payment, leaving the player with a net payoff decrease in comparison to the beginning state. From (α, α) no player has a reason to deviate as this would decrease collective payoff.

However, an outside company could provide to pay the first party just enough so that they will play a_1 and subsequently (α, α) will be reached. The company probably would make a profit as without this company (all other things equal) this final allocation would not have been possible to reach, meaning it will be paid out for causing a positive externality. If estimations set up like this will be accepted and if other forms are also accepted will be preemptively determined by the Estimation Committee, which also holds for the core externality definition used in this section.

To model this scenario, the company's payment to the first player playing a_1 is defined as x. If the company wants to maximise profits, it will choose x to be just above the level that would make any of the two players indifferent to play a_1 or not in the beginning situation of (δ, δ). Thus, if one player starts to choose a_1, they will receive $\gamma + x + \beta - \delta = \delta + \epsilon$ as a payoff (where $\epsilon \downarrow 0$). Depending on the positive externality estimation of the company, they will receive y from the second player (taking it from the first would not initially make them choose to adopt a_1 because of the definition used of x. If x were higher, perhaps some final externality transfer from this player's account to the company's might have been included in the externality estimation). If the second person then also plays a_1, that person will get $\alpha - \beta + \alpha - \gamma - y$. As $y > x$ and $x \approx 2\delta - (\gamma + \beta)$, assuming that $2\alpha - (\gamma + \beta) - y > 0$ means that $2\alpha - (\gamma + \beta) > y > 2\delta - (\gamma + \beta)$, which holds $(2\alpha > 2\delta)$ so that there exists a value of y for which $y > x$ and $\alpha - \beta + \alpha - \gamma - y > 0$. Therefore, the collectively optimum can be reached in the second scenario, too. This will hold as the equilibrium as all deviating actions would decrease collective payoff.

Notice, that in reality the payoff inequality like that between γ and β might be seen as containing an externality as well, but this would simply change the utility values and, in turn, the collective utility values, which means a different game is to be solved. Again,

to avoid confusion, pure utility has been left out of the picture in this example. Perhaps other methods of economic analysis can be used to explain the workings of the Utilitarian Economy even more.

For games containing altruistic players, the same will hold, just like will be the case for games with players who hold a grudge against other players. Namely, as payoffs of personal utility are changed, so are the collective optima.

9.2 Generalised Interpretation

This section will elaborate on the example provided in the previous section by giving a more general mathematical interpretation of the Utilitarian Economy. The following definitions will be used:

- $N = \{p_1, p_2, ..., p_n\}$ where N is the set of n people in the economy, each denoted as p_i with $i \in 1, 2, ..., n$.

- Each person has an action set A_i that contains all the behavioural combinations b_i of possible actions that the respective person can adapt so that $A_i = \{b_{i,1}, b_{i,2}, ..., b_{i,\nu_i}\}$.

- The set of behavioural combinations of all people in the economy at a given time t is denoted as B_t where $B_t = \{b_{1,x_1}, b_{2,x_2}, ..., b_{n,x_n}\}$ (and $x_i \in \{1, 2, ..., \nu_i\}$).

- Furthermore, all people have a utility function $u_i(B_t)$ part of the set U so that $U = \{u_1(B_t), u_2(B_t), ..., u_n(B_t)\}$ and collective utility Υ can be expressed as $\Upsilon = \sum_{i=1}^{n} u_i(B_t)$.

Notice that the utility derived from externality payments is not taken into account in the utility functions provided above by choice to avoid confusion when making the distinction between classic economies and the Utilitarian Economy.

Suppose the economy starts out with a set of behavioural combinations B_t. If there is a player p_i that can adopt a different behavioural combination to increase collective utility, they will choose to adopt this because increasing collective utility means that the personal change in utility plus the change in utility to others is positive. This latter part is settled by crediting or debiting the people receiving positive or negative externalities the corresponding amounts, which totals the collective utility increase (when including the player's utility increase), thus resulting in an improvement in utility for the player. To be precise, not necessarily any behavioural combination that will increase collective utility will be adopted, but the behavioural combination that will maximise collective utility will be played, as this will maximally increase the person's profit in Utility Credits.

If this process continues with other people in the economy, every time step Υ is increased as different people alternately change their behavioural combination to maximise Υ (consequently maximising their personal payoff for B_t). Therefore, if Υ could be represented as a continuous function, it would be as if everybody in the economy behaved to nudge Υ in the direction of the gradient, the direction of the steepest ascent of the collective utility function (in theory, because some people's utility functions might not be adequately represented in the collective utility function 'defined' by the Estimation Committee).

One can probably expect collective utility to reach higher levels with this economic rule in

place more often than not, but it should not necessarily be the case. It is, in fact, possible that there are 'collective maximum traps' on the 'fabric' of the collective utility function that an initial allocation might drive the economy towards. These 'traps' contain relatively low levels of collective utility and because of the negative externality punishments associated with changing behavioural combinations, the economy might not escape to close in on higher peaks on the collective utility function.

In free-market economies, the temporary global optima of personal utility functions that people achieve by picking their behavioural combinations might in theory get society to collective utility levels that are higher than would be achieved in the Utilitarian Economy, for some initial allocations, as the Utilitarian Economy might get stuck in a collective maximum trap.

Nevertheless, it would be naive to assume that there is not some randomness in people's behavioural combinations, uncontrollable environmental changes and a continuous change in people's action sets and utility functions that all reshape the course of the economy and the collective utility function Υ.

One must also remember that in the Utilitarian Economy, there is an incentive for 'companies' that mimic some of the actions of regular governments to bring the economy from the current collectively local maximum to a higher one, as this would pay them collective utility difference as an externality payment. For example, there might be hedging companies that will pay certain economic parties to adopt some action and get the collective utility level to a higher local maximum. Then, a new equilibrium will be reached as from such a point all other actions would entail losses for the deviating party. In the previous mathematical example, this was also shown to work theoretically in at least one scenario.

One should consider that advanced tactics in the economy can arise, as players might notice that in some cases waiting for other people to change their behavioural combinations first will enable them to adopt a behavioural combination that will make the sum of their personal gain and externality payoffs higher than otherwise (assuming they will bring the economy close to a local maximum so that not much will change after they have changed their behavioural combination).

Nevertheless, in a dynamic economy, these local maxima are hard to predict so that it is proportionally hard to predict which behavioural combinations of others would lead to higher payoffs (in combination with the fact that predicting behavioural combinations is hard). The exploitation of the system, in extreme cases, will probably lead to punishment by the Estimation Committee or jural systems.

Lastly, pure utility would only be the means of bartering in the economy if all personal utility functions were aligned with the democratically determined definition of utility. Although it is collectively defined so that on average it might not be far off, one can expect large variability in the personal utility functions of the economy citizens compared to the collective one. Therefore, although one might suddenly earn twice the amount of utility credits, this would not necessarily be worth twice as much to that person in personal utility terms, as this decrease is subject to the collective utility definition, not to that person's personal utility definition. It should be noted, though, that people will probably rarely be indifferent to

externality adjustments to their accounts. In most cases, the externality adjustments will be seen as a proper incentive or disincentive, if anything, on average more aligned to their personal utility function than the unit of exchange in free-market economies.

9.3   Comparison

The comparison of the Utilitarian Economy and standard economies will be a fairly brief one because there is a lack of evidence relating to the proposed economic architecture. One inequality will be determined that has to be satisfied so that a transfer to the Utilitarian Economy from a regular economy would be collectively viable. The following definitions will be used:

- There are two economic systems, E_1, a regular economy and E_2, the Utilitarian Economy.

- In two perfectly equal societies, one of the two economic systems is adopted so that there is one society in which E_1 is in place and another with E_2.

- Both societies, as they are perfectly equivalent, have the collective utility function Υ, comprised of all individual utility functions.

- Both economic systems define the collective utility function to be Υ'_1 and Υ'_2, respectively. As explained before, both of the economic systems define them in a roughly equal manner, so that the difference between the output values of the functions is negligible given any input.

- Because of the associated definition inaccuracy, both collective utility definitions will carry the inefficient cost of i, with $i > 0$.

- Every time period, on average E_1 and E_2 produce the transaction costs of τ and T, respectively, with $0 < \tau < T$.

- Every time period, on average E_1 and E_2 are collectively inefficient so that they contain the inefficiencies of I and ι, with $I > \iota > 0$.

- As τ, T, I and ι will depend on a plethora of variables, they can be said to exist in a chaotic system that will seemingly randomly determine the emergent value of these variables around their mean. However, nothing can be said with certainty about these variances without any evidence so this part of the variables is left out of the question to be dealt with in future research.

- In the long run, the transaction costs t with $t \gg 0$ that are incurred when making a transfer to the Utilitarian Economy will amount to a periodic transaction cost of $\lim_{x \to \infty} \frac{t}{x} = 0$.

- Emergent collective utility in E_1 can thus be expressed as $\Upsilon - i - \tau - I$ and in E_2 as $\Upsilon - i - T - \iota$.

Logically, E_2 would only be the preferred option if $\tau + I > T + \iota$ holds. More evidence has to exist to be able to at least make any bold claims about how these values compare so for now this is left as an inequality to test for in experiments.

10 Economic Facilitation

This section will explain how the Utilitarian Economy facilitates the emergence of certain social constructs that are crucial factors in contemporary societies.

10.1 Government Projects

In the Utilitarian Economy, the public goods that classic governments provide will be provided by the market. For this reason, like argued before, higher efficiencies can be expected, where the definition of effectiveness used here is the optimal allocation of resources according to the democratically defined utilitarian framework. When certain transactions impact the whole of society, like building a national water defense system (for some small countries), the positive externalities could simply be taken from the accounts of everybody in society, just like taxes would. It would therefore be naive to expect a full-form governmental body to arise next to the Estimation Committee, although the possibility exists that copies of certain departments will arise in private form.

10.2 Jurisdiction

An appropriate question at this point would be how the legal system will be formed. Although seemingly daunting, questions like these actually have a very simple answer: legal constructs will be formed that are the most profitable, in other words, the most contributing to collective utility. If those indeed seem to be where there is a central system setting up rules to be adhered to by all parties involved, this will be what manifests itself in the economy. If police and other collaborative organisations to the legal system seem to be collectively optimal, these systems will be adopted, or actually remain unaltered after the adoption of the Utilitarian Economy, but completely different systems are not out of the question.

Suppose the following hypothetical example that further clarifies its workings: certain economic parties are secretly transacting with each other to evade the negative externality penalties related to their actions. In this case, organisations similar to the police will be rewarded for protecting the economy against behaviour that limits its potential and for the externality amount they register with the estimation of the evaded externality amount. The legal system will then be rewarded for possible prosecution in proportion to whatever externality would be relevant in the particular case. Just like these, companies or individuals providing estimation and voting services will impede the democratic aspect of the economic system and could be terminated. On the contrary, companies educating the people on the estimation process could prosper as they generate positive externalities.

Lastly, as hinted at before, openly publishing important information for the externality estimation processes will be crucial for this type of economy just as it would for regular economies. If there are large positive externalities associated with the action of publishing sources of your company or organisation, this will indeed be an incentive. Moreover, the legal system can even punish companies or individuals withholding the information it deems essential for the efficient working of the economy.

10.3   Social Welfare

Regarding the workings of economic transfers between people, the transaction and externality types may not be so obvious at first thought. Notice that it depends on society's definition of externalities if transfers of income and wealth can take place at all, based on individual economic prosperity. If society has defined some levels of income to be below appropriate standards, one could define not helping these people as a transaction (inaction also being an action) with a negative externality value (because of its net emotional cost to society's participants and thus collective utility). This, in turn, means that externality estimation is possible and people are incentivized to submit estimations and vote for them, meaning monetary transfers will occur. Other social welfare systems are possible to arise, too, for which the same line of argument can be followed as is given for the scenario in this paragraph.

10.4   Education

Now that the most important lines of arguments have been provided, it is not so hard to imagine how a system of education would emerge. If standardised education entails the highest positive externality (or the least negative one) among other systems of education, this type will most likely be adopted. If these systems do not provide primary education to all, possibly high negative externality amounts will be taken from the accounts of these schools to encourage them otherwise. Similar to the line of argument in the previous paragraph, if insufficiently cheap secondary education is estimated to contain negative externalities associated with the inaction of all adults in the economy, secondary education will become cheaper.

10.5   International Trade

As possession of the digital currency usually goes hand in hand with democratic privileges, separate accounts without these should be set up for people outside the democratic system earning these 'Utilitarian Credits'. Externality estimation relating to foreigners' transactions will still take place. Just like possible fines when doing business abroad, entrepreneurs will need to take the risk of assuming negative externality adjustments into account. When participants of the Utilitarian Economy do business abroad they will logically have to exchange some of their Utility Credits with the foreign currency. If externalities are defined to be relevant for those transactions abroad (relevant to participants of the Utilitarian Economy, perhaps indirectly), the account will be credited or debited depending on their value. Thus, all accounts registered to be part of the Utilitarian Economy will be subject to the system of utilitarian adjustment that, in turn, depends on the utilitarian framework set up indirectly by the electorate.

If international trade is impeded by the utilitarian currency fluctuations and this causes substantial underlying negative externalities to a group of participants of the Utilitarian Economy, estimations will likely make it so that trade partners would get for their money what they usually would and domestic economic participants engaging in economies abroad will be able to buy what they normally would be able to buy for any amount of Utility Credits.

10.6   Central Banking

As has been shown before, perhaps all functions of contemporary governments can be taken over by the emergent systems of the Utilitarian Economy. Now, it will be shown that this holds for the core goals of central banks, too. Suppose society is currently starting to fall into a recession, which is generally not desired (or suppose it is not by definition of the Estimation Committee). In this case, people who engage in economic activities, for example by buying goods or services, will produce a positive externality as they contribute to an economic recovery, making their purchases cheaper. Of course, the whole of society will pay for the externality embedded in a single purchase (in minuscule amounts) as they are benefitted from it. Now, not engaging in economic activities means that Utilitarian Credits will just keep dripping out of your digital wallet, without you profiting from cheaper products and services. This creates an incentive for all participants in the economy to consume, just like would be the case for increased inflation levels, which carries the well-known effects to curb a recession. If the economy is initially on the opposite end of the business cycle and the utilitarian framework suggests that economic stability is an important contributor to collective utility, the inverse externalities will be defined and do the same job and stabilise the economy.

11   Adoption

Perhaps the most important point of this section is if existing economies would actually adopt this type of economy. In short, the risk of a turbulent instant transfer right now most likely seems too high, even though a democratic government in power, serving the public, might be in favour of an economic architecture that could to increase collective utility. Experiments should first be conducted to find out if this economic architecture is actually beneficial to the people and if a transfer would run smoothly.

Nevertheless, it is not impossible to make predictions about what would happen right after a transfer. Before something will happen in the economy, the members of the Estimation Committee will have to be elected. After the political campaigns took place and the electorate voted, large gains in the estimation process will abound, so people will scramble to estimate the highest externalities present in the economy. If the current legal system and other non-governmental bodies are thought to maximise the collective utility, these will stay in place or at least undergo some gradual structural changes. The regular government will not be necessary anymore and consequently lack funding.

After a while, one can expect the economy to stabilise as people grow acclimatised to the system at play. Some might change their full-time occupation to one where they look for transactions containing unnoticed externalities and collecting evidence to subsequently fill in and submit the estimation template to the Decentralised Allocator. As is also the case for regular governments, wherever the personal transaction cost of externality estimation exceeds the absolute value of the externality size, the externality will not be estimated, but adjusting these transactions would logically produce little collective gain. If there are a lot of these transactions, though, the possible improvements to society can be substantial. A compromise might be made to estimate these transactions less accurately. In the end, there will always be transaction costs associated with the estimation of externality values and the people they impact, regardless of the economic architecture in place.

But would contemporary governments and the public be willing to transfer to the Utilitarian Economy even if it has proven that it indeed leads to the argued benefits? Some multinationals causing large negative externalities might certainly lobby against such a change. If the Committee's definition of collective utility to be adopted will improve estimated collective utility more than contemporary economies would, democratic systems are more likely to be in favour of a transfer than not.

Even if societies are not in favour of a full transfer to the Utilitarian Economy, they might also consider implementing the economic architecture partly. Namely, for some transaction adjustments, the Utilitarian Economy might have advantages over regular economies, while for other transaction adjustments regular economies might be preferred. It is not hard to imagine how these two systems can be configured to work together in practice. For example, if externality estimations relating to transactions of projects and institutions of the regular government are illegal to submit to the Decentralized Allocator, the regular government structure and institutions can continue to exist.

12   Concluding Remarks

In conclusion, the Utilitarian Economy seems to have the potential to increase collective utility in contemporary economies without compromising on the crucial systems in their respective societies. What remains, at this point, is, first, to do more research into the possible difference in transaction costs and collective efficiencies between regular economies and a form of the Utilitarian Economy. Additionally, the digital system should be expressed in code, after determining all the small details of a realistic implementation of the Utilitarian Economy (some have been left out of this paper to promote flexibility in its design). This should probably be done in the Solidity programming language for smart contracts deployed on the Ethereum Mainnet if a blockchain indeed seems capable of processing all transactions and storing the relevant data. Finally, and most importantly, experiments are to be run. While performing these tasks, one should remember that the ideas put forward in this paper are not set in stone. Different versions of the economic architecture proposed may produce results that improve on the ideas that might lead to increases in the collective utility in economies.

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