Eranism: a Transparant Economy
(work in progress)

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Abstract

This is the design of Eranism, an economy that would allow for more prudent use of natural resources, a wasteless and mostly fair distribution of goods, more cooperation than in the present competitive economy, and the reduction of work for which there is no physical necessity. The economy is decentralized in the sense that people themselves report how many goods they want or need and how long they have to work, but it usually does not pay to misreport in order to manipulate the outcome. The economy is directly based on physical and social reality (it is said to be transparant) and therefore does without money. To complete the design, a few questions remain to be answered.

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Chapter 1

Introduction

"Economic activity must be bolted to biophysical reality," as William Rees put it.[1] This document describes an economy called Eranism that meets this objective – it is *transparent* in the sense that its outcomes are only, and directly, based on reality, more precisely, on the historical and the predicted state of affairs, including personal preferences. This economy has several other features. It is decentralized because its participants themselves report their preferences – and they usually profit most by reporting the true state of affairs. That state of affairs includes the efforts made, the predicted effort, the amount of goods present, and the desired or needed amounts of goods and effort. Also, this economy allows for mostly fair distribution of goods and for reasonable remuneration of effort. Finally, participants profit from cooperation, such as by making donations. Notably, no deliberation is needed. This economy does without money, which only is an indirect account of reality. It should run on a global database without human interference except for software updates.

Currently, this document is a design intended for programmers and mathematical economists. It would have to evolve to a public reference guide that exactly matches the implementation and that explains why certain choices have been made. Only knowledge of basic set theory and predicate logic (that is, logic with quantifiers) is required to read this document.

The name of the economy, Eranism, should be temporary. It derives from classical Greek and refers to mutual assurance.

1.1 Goals

The most important goal of Eranism is to contribute to containing the polycrisis but this may be possible only to a limited extent. One reason for this

[1] William E. Rees (Aug. 2026) The Road Not Taken that Cannot Be Taken, *Mother Pelican*, vol. 2, no. 8. `https://www.pelicanweb.org/solisustv22n08page11.html` Republication of Substack blog `https://reeswilliame.substack.com/p/the-road-not-that-cannot-be-taken`

limitation is that Eranism allows to ration goods and limit labor effort in order to slow down the biophysical collapse, but the price for rationing may be high. For instance, to reduce global warming, less carbondioxide (a greenhouse gas) should be emitted, so the combustion of fossil fuels and biomass would have to be stopped immediately, which would imply a decimation of energy supply.[2] Therefore, such rationing is unlikely, in particular if it implies that there would not be enough energy for everyone. In other circumstances, rationing may become necessary. For example, a day zero for water is likely in several cities.[3] If there is not enough water for everybody, then a decision is needed who receives water and who does not. That decision may be made by a decentralized procedure such as the simple need-based rationing in this document, or by more sophisticated triage.[4] Another reason that a new economy such as Eranism would have limited effect is that rationing may be too late anyway. For example, global warming may not be slowed down because of tipping points and the prediction that stopping combustion of fossil fuels and biomass will reduce the amount of aerosols (soot in the air) and thus further raise the surface temperature. Therefore, rationing the remaining energy will be to little avail.

On the other hand, to address the biophysical collapse and inequality, cooperation is needed, to which most people are naturally inclined under favorable circumstances – and Eranism makes cooperation most profitable.

If sufficiently many people endorse the goal of combating the polycrisis and embrace this moneyless economy, another goal emerges: to make money by deploying Eranism, as money probably is here to stay.

1.2 Problem

The current economy is not transparant as it only indirectly relates to reality. First, it does not properly relate to biophysical reality because it is an important driver of resource depletion, pollution, and mass extinction. Second, the current economy ignores the preferences of most people because it contributes to great inequality and forces most people to act contrary to their common sense or cooperative nature. These problems for a good deal are due to politics and human nature, but this document only addresses two economic causes.

One cause is competition and the lack of regulation, which may lead to selfish action that is not as profitable or sociably as cooperation and that may lead to exhaustion or pollution of common resources.

Another cause is money. Although money determines everyone's personal

[2]Our world in data (June 30, 2026) *Global primary energy use by source*. `https://ourworldindata.org/grapher/global-primary-energy-by-source`

[3]K. Madani (2026) *Global Water Bankruptcy: Living Beyond Our Hydrological Means in the Post-Crisis Era.* Richmond Hill, Ontario: United Nations University Institute for Water, Environment and Health (UNU-INWEH). `https://dx.doi.org/10.53328/INR26KAM001`

[4]For example: Parag A. Pathak , Tayfun Sönmez , M. Utku Ünver, and M. Bumin Yenmez (June 2024) Fair Allocation of Vaccines, Ventilators and Antiviral Treatments: Leaving No Ethical Value Behind in Healthcare Rationing, *Management Science*, vol. 70, no. 6, pp. 3999-4036. `https://doi.org/10.1287/mnsc.2022.00930`

reality, such as food, it is not a representation of absolute reality, only of man-made relations, as can already be seen from the following classical definitions of money by Jevons.[5] Money has an exchange value as it allows to obtain a good or service. However, that exchange value is not an intrinsic value of the good, but a measure of it scarcity, due to the law of supply and demand. Nor does money measure one's hard work, it only indicates the exchange value of the result of that work. Still according to Jevons, money is a commodity in its own right, also governed by the law of supply and demand.[6] This insight runs parallel to the more elaborate Marxist theory that money is *reified* or *objectified*, which means that it leads a life of its own and becomes a fetish.[7] As money is an independent entity that does not represent absolute reality, it creates an increasingly illusory world of abundance and undeserved wealth. It thus also increases inequality, with a milestone reached by Elon Musk, who in June 2026 became the world's first trillionaire,[8] only to lose almost a third a month later[9] within a week.[10]

If illusions can thrive, so can fraude. When money is a goal in its own right and competition is the main rule, then planned obsolescence, waste, exploitation, and the creation of false needs are the prime strategies for obtaining profit. Already in 1883, this observation led Paul Lafargue to call the two centuries of capitalism that had elapsed by that time: the fraud age, or *frauducene*, as he would have called it nowadays.[11]

Last but not least, money has facilitated global trade and thereby overproduction, which have turned out to be harmful to the environment.

Not surprisingly, the solution would be to abolish money and to design a mechanism that discourages fraud.

1.3 Proposed Solution

Money is replaced with *grants* for a certain period and with *earnings*. When somebody (the *assistant*) has rendered a service to someone else (the *client*) in a certain period then the client (or more generally, an *attestor*) pays the assistant

[5] William Stanley Jevons (1880) *Political Economy*, New York: Appleton. Sections 73-75. `https://www.gutenberg.org/cache/epub/33219/pg33219-images.html#CHAPTER_XII`

[6] Section 78 in Jevons.

[7] Titus Stahl (2018) Georg [György] Lukács. In: E. N. Zalta (ed.) *The Stanford Encyclopedia of Philosophy*. `plato.stanford.edu/archives/spr2018/entries/lukacs/`

[8] Matt Durot (June 17, 2026) SpaceX's IPO Just Made Elon Musk The World's First Trillionaire, *Forbes*. `https://www.forbes.com/sites/mattdurot/2026/06/12/spacexs-ipo-just-made-elon-musk-the-worlds-first-trillionaire/`

[9] Bloomberg (July 31, 2026) # 1 Elon Musk $684B, *Bloomberg Billionairs Index*. `view-source:https://www.bloomberg.com/billionaires/profiles/elon-r-musk/`

[10] Grace O'Donnell (June 24, 2026) Elon Musk loses trillionaire status, according to billionaires index, *Yahoo! Finance* (i.e. Bloomberg's index, $957B). `https://finance.yahoo.com/markets/live/stock-market-today-dow-rises-sp-500-and-nasdaq-slip-as-ai-jitters-return-ahead-of-micron-earnings-230105138.html`

[11] Paul Lafargue, (1999) *Le droit à la paresse* [The right on idleness] Paris: Allia. `https://www.marxists.org/francais/lafargue/works/1880/00/lafargue_18800000.htm` On pages 11, 47-49.

an *effort index*, a number that reflects the labor intensity. The effort index goes off the grant for that period, so that grant rapidly vanishes. The earnings of the assistant consist of all effort indices (or payments) taken together. At any time, the participants use part of their earnings as a bid to obtain goods, after which the bid can no longer be used. Therefore, participants increase their earnings by working and diminish them by spending on goods. All in all, grants become earnings and earnings become goods to be used, so grants and earnings do not circulate and can not start to lead a life of their own.

To determine the grants, earnings, and the amount of goods, participants gather in groups. At the start of a period, the group members report their requests for goods and services. Prospective assistants, possibly from other groups, make quotations which, once accepted by clients, determine how much a client would have to pay, that is, how large his or her grant would have to be for a particular period in order to register the effort of all assistants. However, everyone receives the same grant to begin with and the actual grant is the result of donations by those who have too large an initial grant to those who have an insufficient initial grant. Donors judge whether a recipient really is in need. If the recipient has multiple assistants and clients, then each client judges the estimated effort ("price") to produce goods or render a service for him or her. Clients may also donate to a *fund*, amongst others to suppress collusion, that is, the secret circumvention of the rules. The participants can also challenge the height of grants.

When the time has arrived to allocate the requested goods, the group members place part of their earnings as bids (by default, a fixed portion of their earnings). The bids count relatively: If everyone doubled his or her bid, everyone would receive the same allotment. A bound may be placed on the amount of goods to be allocated. The allocations are such that the best strategy to get what one really wants or needs is to truthfully report it. More generally, the economy is such that misreporting the state of affairs (in order to manipulate the economy) leads to less profit or a risk thereof.

Trade is possible: People can obtain goods from groups they did not work for *as if* they did work for them by an automated rearrangement (trade) of the goods and efforts.

All in all, because of the improfitability of fraud and the lack of excessive competition, this moneyless economy may allow people to cooperate more and, when something is given to them, to feel less obliged to do something in return. This economy may also put a halt to gross inequality and senseless production, thereby diminishing pollution and resource extraction, while in most cases, it also allows fair distribution of an insufficient amount of goods, irrespective of whether that amount has been restricted by authorities or by nature.

1.4 Outline

Chapter 2 introduces some concepts of Eranism and Chapter 3 explains how they are processed. Chapter 4 raises questions.

[**Following is in progress and only mentioned in the table of contents.**]
Appendices give detailed descriptions of implementations (including proofs), design considerations about the choice of the solutions, and some general results.

Chapter 2

Concepts

All data are to be stored in a relational multi-user database that relies on self-registration as far as possible.

2.1 Persons and Participants

A *person* is someone in physical reality. A *participant* is a basic datum with which efforts and amounts of goods are associated. Every participant consists of a unique combination of *given name* as a single text field, the most accurate *place of birth* and *moment of birth*, if possible in the time zone of the place of birth, the sex (male or female, only to determine the default maximum labor time) and possibly other personal data that do not change. As a proof of unique registration, a scan of the identifying parts of a passport, identity card, fingerprint or other unique property is optionally stored, and so is a certificate that proves incapability to work full-time. Supplementary data are a unique *full name*, an immutable surrogate key, and a unique *user name* with which to log in (possibly, multiple times, thus creating multiple sessions). All of the above data are displayed to every other user. Additionally, to every participant is associated a *passkey* such as a password, that is, a datum hidden for other participants. Entry of the passkey is a requirement to log in.

For participant p let f_p in $(0, 1]$ be the *labor reduction factor*, which will allow to reduce the default maximum labor time. Its default is 1. Participants whose factor is too large, for example because of a handicap or chronic illness, may set it to a lower value. These values will have to be accepted by the person whom the participant works for.

Any person can create a participant, not necessarily for himself or herself.[1] A person logged in as a participant is also called participant for sake of brevity. A participant can only change or delete the data of, or depending on, that participant. (Therefore, a participant has no date of death.) A participant sets

[1] Expressions such as 'he or she' are understood to include anything inbetween, so as to avoid more cumbersome expressions like 'they' for non-binary persons.

an *idleness period* that gives the start date by which he or she will not render any service, along with an optional end date. If the end date is empty and the participant wants to become active again, then he or she must specify it to indicate being candidate for rendering a service.

There is *identity fraud* when a single person is registered as multiple participants. To suppress it, a participant can flag another participant as suspect, for instance because a passport scan is missing. Every participant can see whether such flags exist for any other participant. Identity fraud may have limited impact if participants need to identify themselves when appearing as persons to render a service or to fetch goods.

See Section E.2 for design considerations.

2.2 Goods and Stores

A *good* is a commodity, such as an apple or energy. A *goods type*, such as fruit, is a free-format label of an allocation of similar goods.

A good can be of multiple goods types, for instance, apples are allocated as fruit or as an ingredient (pectin) to thicken food. *Allocations procedures* may be of different types. Each instance of an allocation (of a particular type) is identified by a combination of the goods type and an *allocation period*, that is, the time between runs (or length of a cycle) in seconds. A *store* is a location that lists goods, that is, their description, their amounts, and a reference to an allocation for its goods type and allocation period. For example, an allocation for goods type 'fruit' that runs each three days is referred to by an entry in the store that mentions 5 for a good described as 'apple'.

2.3 Efforts and Grants

A *service* is work that one participant (the *assistant*) does for another (the *client*) or a group of people, for example when contributing to a *public good* (a good that is not affected by the number of consumers, such as a flower bed to look at). A client is also called *customer* if he or she receives a good from an assistant (the *producer*). An *intermediary* is a participant who has assistants (employees, personnel) work for him on behalf of clients, such as a baker (employer) who has employees and customers. Notably, the intermediary is client of his or her personnel. Importantly, an assistant from one group may work for a client from an different group.

Each service has a *service type*, taken from a set T that is determined in the computer program, as a 'factory setting'. For example, service type τ is 'hard physical labor' with illustrations and objective specifications, such as the number of calories burnt per hour. Other properties of a service are prospective assistant, prospective client, prospective attestor if different, reported estimated start time, reported estimated end time, and optionally, end time reported by

the assistant (thus yielding effort index) and effort index reported by the attestor.

A *time unit* is a number u from $\mathbb{R}_{>0}$ in seconds. For each service type τ, time unit u, sex s, and age ℓ, there is a default *maximum labor time* $m_{\tau us\ell}$ which typically is the maximum that is physically or mentally healthy. For instance, the maximum labor time for hard labor by women per day is four hours. These data are based on scientific findings and also a factory setting. For assistant h, where 'h' for 'helper', let $s(h)$ be the sex of h and $\ell(h)$ his or her age, computed from the date of birth. For service type τ and time unit u let

$$b_{h\tau u} := f_h m_{\tau u\, s(h)\, \ell(h)}$$

be a bound to the labor time (*labor-time bound*) that will be accounted. (The factor f_h is the labor reduction factor defined in Section 2.1, p. 6.) To stress that bound b is defined for particular time unit u it should be given as the pair (b, u).

If h spent w_h seconds on service of type τ during an interval of length u then the *effort index*, *labor intensity*, or *maximum time equivalent* (*MTE*) is the fraction

$$I_{h\tau u} := w_h / b_{h\tau u}$$

where again, an intensity I should always be accompanied by time unit u and if necessary, be denoted by the pair (I, u). However, the unit u is fixed to a day for this economy, in particular, bounds are only specified for a day because everyone needs sleep at night. Rights such as the right to pause during a day's work or to have a day off each week (the weekend, usually) are not defined in this economy (because they cannot be established objectively). The effort index is recorded by an *attestor*, who usually is the client but may also be the representative of the group for which the work is done. The attestor accepts the type of work τ and the factor f_h, and records w_h but not more than $b_{h\tau u}$. The resulting intensity is called the *earnings* of h for a particular group, such as the group of the client. The total earnings of h is the sum (in any order) of the earnings for services of various types during the interval. If recorded truthfully, the total earnings of a day can not exceed 1 and if they do, they are truncated to 1. Therefore, labour from which one can not safely recuperate is not recorded. Notably, the earnings of multiple days usually do exceed 1.

The idea is to let participants define a bound to the labor of the group in order to avoid working as hard as possible only to compete and to discourage overreporting. (Classical mechanism design, such as screening to encourage truthfully telling a fact of Nature, does not use bounds.) This bound is defined for every participant as a *grant*, which is an amount of effort index from which to *pay* an assistant, that is, to register his or her earnings. (The grants discourage collusion: A client is reluctant to overpay an assistant in return for something else because the client then would be left with a lower grant to pay for unexpected labor. However, without further measures, they could collude to let higher grants be created.) There is also *fund* from which assistants will be paid automatically. Section 3.2.1, p. 15 gives the details.

Design considerations and backgrounds of effort are in Section E.4, p. 93 and those of grants are in Section E.6, p. 99.

2.4 Groups and Authorization

An *allocation group*, or simply *group*, is a collection of participants who consider a service to one member as indirectly profitable to themselves. At regular intervals, its members use a procedure to collectively determine how hard they will work. They also let goods be allocated according to each member's effort and needs or wants. In other words, group members cooperate.

Groups may overlap, that is, a participant may become member of multiple groups to more directly obtain goods from those groups on the basis of work for these groups. However, he or she will have to distribute attention (and effort index for obtaining goods) over those groups, which can be a disadvantage compared to members who are in only one group.

A participant who is in a group and joins a second group can not bring his or her earnings to the new group – these earnings are still made for the first group. However, he or she can offer these earnings as slots, as they are called, that can be used by participants from other group ('foreigners') to trade goods, that is, use them as if the foreigners did work for the first group. For that to be attractive, the first group should still allocate goods, so it is a disadvantage to leave a small group. Therefore, groups will be depopulated only slowly.

Every participant can create a group. The creator automatically becomes member of that group. Each participant can join or leave any group. (Therefore, if a group becomes too large, a member may create another group and hope, or expect, that others of the group will join the new group.)

2.4.1 Store Manager

A *store manager* maintains the store, that is, adds and removes goods from the store table, and creates an allocation. (See Section 2.2, p. 7 for these concepts.) The store managers may not change the identity of the allocation (goods type and allocation period) but they can delete an allocation if no goods refer to it. (Allocations without goods are only visible to store managers.) The amount of goods (of a particular type) to be allocated is the sum of those goods in the stores of the group.

2.4.2 Goods Manager

A *goods manager* can create a store and assign store managers to it as well as remove store managers (though not remove stores or allocations). There is at least one goods manager in a group. Goods managers can also *ration*, that is, impose an upper bound to the total amount of goods that are allocated for any allocation in the group. Therefore, the goods managers need to keep an eye on the goods types being created.

2.4.3 Group Manager

A *group manager* is a participant (one per group) who may assign the role of goods manager to members or revoke this role. By default, the creator of a group is a group manager and a goods manager. The group manager may also set the *grant period*, that is, the length of the grant cycle, as described in Chapter 3, p. 11. At any time, a member can offer to become group manager. If there is no group manager (he or she has left the group or retracted the role from himself or herself) then the candidate becomes the group manager. Otherwise (the group manager malfunctions or no longer wants to be group manager) then every member can cast a vote for the candidate or for the present group manager within 24 hours after the offer. The winner is the one who collected the majority of votes. In case of a tie, the present group manager stays, in particular when there are no votes, for example, due to voting fatigue. Right after the election, a new election may start, so new candidates (including the loser of the previous election) may present themselves.

Section E.3 collects the reasons for creating the concept of a group and the procedures around it.

Chapter 3

Processing

A member of a group may take the following steps, many of which are defaulted or automated.

First, for a particular good or service, a member may do the following at any time in the order indicated.

Request of services A future *client* requests prospective *assistants*, possibly not from his or her group, to render a service in a particular time interval. The service may be labor to produce a desired (or needed) amount of goods.

Anticipation of service requests A prospective assistant may produce unrequested goods or render an unrequested service, as when protecting unprotected property in case of emergency.

Estimation of effort Prospective assistants estimate the end date, duration, and maximum labour time of the kind of work, that is, the effort. This estimate includes unexpected work. Intermediaries can let the estimate be generated from the effort for total set-up, per-type set-up, and per-item set-up. When the service is requested by a future client then they present the estimate as a quotation for that client. Work that is not finished at the estimated time must be offered anew. Anticipated effort is also estimated but not offered as a quotation. Details are in Section 3.1, p. 13.

Selection of quotation The prospective client selects a single assistant to render the service (and becomes a client) or rejects all quotations. The assistant can now start to work.

Request of goods to be allocated A participant requests goods from an allocation of a certain group. Others may have requested these goods or produced them to anticipate request (the effort to produce the goods would be rewarded). A customer who asked prospective assistants to produce an amount of goods must request this amount of goods from the allocation of

the group of the selected assistant. Notably, the participants may request goods from other groups than the one they have worked for.

Participants are also subjected to three (not necessarily synchronous) cycles, the first one of which is the following.

Grants cycle At the start, the computer determines the reported effort estimates (to compute its total, $\hat{f}_{NN}$) of work of which the estimated end time falls in this cycle or before and for which the assistant did not fill out an actual end time. Next, clients collectively determine (without deliberation) the grants (and a fund) labelled by this cycle. (They decide how to distribute $\hat{f}_{NN}$ over grants and fund, and whether to agree with proposed donations of parts of their initial grants; they may also challenge one another.) The details are given in Section 3.2.1, p. 15.

Continuing for a particular good or service, participants now do the following.

Payment of earnings Once work is done, the assistant reports the effort and an attestor (usually, the client) pays effort index from the designated grant, that is, the payment diminishes the grant. The client may pay less than reported if he or she is dissatisfied, or more than reported if colluding with the assistant. See Section 3.3, p. 18.

Request of bids Participants request to submit part of their earnings as bids in order to obtain goods from a group. If they worked for this group, then the request is honored, that is, the participant just specifies the bid. If they cannot derive a substantial bid from work for the group, then the request to bid is only honored inasfar somebody who did work for that group indicates that he or she is not going to use those earnings and wants to exchange them, that is, those earnings are a *slot*. This allows trade, as in the third cycle below.

As earnings (not just payments due) can be used as a bid at any time, the following is a separate cycle.

Trade cycle To trade goods between participants that insufficiently worked for each other's groups, earnings are automatically exchanged with participants who did work for that group but who offer slots, that is, indicate not to be wanting goods from their own group. This cycle has irregular intervals because exchange may be postponed until a reasonable amount of trade is possible. See Section 3.4, p. 18.

Participants now wait for the next allocation:

Allocation cycle The goods are allocated based on the request for goods and the bid of earnings. Section 3.5, p. 19 describes the allocation algorithms.

Some of these steps are detailed in the following.

3.1 Estimation of Effort

Once prospective client c has requested a service s from candidate assistant h, the latter estimates start time, labor time w_h and service type τ, that is, the maximum labor time. The labor intensity is $f_{hcs} = w_h/b_{h\tau u}$ where the time unit u is a day. (The letter 'f' is for forecast.) Assistant h reports this intensity as $\hat{f}_{hcs}$ to client c. Only h knows the true (that is, honest) estimated effort f_{hcs}.

For a given grant cycle, let S be the collection of services that have an estimated end time before the end of this cycle and that have no actual end time reported by the attestor, so they are still estimated. These are the services that are expected to acquire an actual end time during this cycle and which therefore are to be paid from the fund and the grants. Examples of S are 1. the regular case of work that is estimated to finish in this cycle, 2. work that was both started and estimated to finish during the previous cycle, so that could not be classified as Example 1 in the previous cycle. Example 3 would be work that was estimated to finish before this cycle but that has no actual end time because the work is still unfinished. However, as said, this service is ignored because the estimated end time is history; the assistant must estimate the end time anew in order to activate the service.

For assistant h and attestor (typically, client) c let $\hat{f}_{hcS} := \sum_{s\in S} \hat{f}_{hcs}$ be computed at the start of the cycle. Undefined $\hat{f}_{hcs}$ are skipped in the summation, a convention to be used in the sequel. Let $\hat{f}_{hc} := \hat{f}_{hcS}$ to do without S from now on. For group N, the total reported effort by h for all attestors i of h is $\hat{f}_{hN} = \sum_{i\in N} \hat{f}_{hi}$. Notably, f_{hN} includes unplanned labor, such as for an unexpected emergency, and labor for anticipated demand.

Let $\hat{f}_{NN} = \sum_{i\in N} \hat{f}_{iN}$ be the total estimated effort. It will be the upper bound to $\hat{e}_{NN}$, the total of reported efforts $\hat{e}_{hc}$, that is, it enforces $\hat{e}_{NN} \leq \hat{f}_{NN}$. Here, $e_{hc} := e_{hcS}$ is the sum of efforts e_{hcs} that h made for c to render service s and $\hat{e}_{hc}$ is its reported value.

Design considerations see Section E.5 but also in the next section to clarify the set-up.

3.2 Distribution of Effort Index

This section is about the distribution of bounds to the payments, that is, the registered effort. First, here are some reasons why bounds have been introduced and second, why they are being distributed the way they are.

The bounds suppress collusion, that is, contracts which bypass the "rules of the game." To illustrate collusion, suppose there were no bounds to payments. Client c could easily overpay his or her assistant h, that is, pay $\hat{e}_{hc}$ while $\hat{e}_{hc} > e_{hc}$, if the assistant promises to do something in return, for instance, share the extra goods obtained with the additional earnings, or the assistant could overpay the client: $\hat{e}_{ch} > e_{ch}$. If, however, payments are bounded, then overpayment poses the risk that there may not be enough to pay unexpected work. This bound is determined from the estimate $\hat{f}_{hc}$ announced by h.

However, and this is the second point, without further measures, the announced estimate $\hat{f}_{hc}$ (to be used for the bounds) is still susceptible to collusion: the assistant may untruthfully state $\hat{f}_{ch} > f_{ch}$ and the client, who knows this is overstated, will pay $\hat{f}_{ch}$ but expects something in return, as before. To contain collusion, an attestor other than the client may inspect the work of the colluders, that is, challenge it, but this will not happen often. Therefore, participants receive grants from which they may pay effort index, and they donate the unnecessary part of grants to each other, so they judge whether the forecast (estimate) $\hat{f}_{hc}$ of the effort is reasonable. The mere threat of such inspections and judgments is also helpful. There is also a fund, which poses a bound on the total payments. Any overreporting of an effort estimate $\hat{f}_{hc}$ will allow more payments from the fund not only to h but to all others, making such overreporting rather futile (at least, when other do not overreport). Moreover, the fund allows recipients to not rely on donations from participants only. However, a fund is a bound to which participants are less sensitive and it allows for malicious misreporting of effort. These properties will be elaborated below. Notably, prospective assistants who make quotations would compete to offer the lowest estimate for the same result but they too may collude when tendering.

To summarize, without donations and challenges, assistants could easily collude and create their own income "out of thin air," for example, by offering each other high "quotations" and register the "work" afterwards. To contain collusion, the clients can 1. donate part of the initial grant to others, that is, redistribute the initial grant, 2. contribute to the anti-collusion fund, which is also a donation, or 3. challenge clients whom they suspect will pay overestimated effort (that is, who collude).

Members must complete the donations (to each other or to the fund) and challenges before the end of the grants cycle. The donors need not expect anything from their donations in return directly, but the donations are beneficial to the donor directly or indirectly. For, the recipient may need to pay the donor from the resulting grant or pay somebody else who produces something that is (perhaps indirectly) advantageous to the donor. In other words, these donations "keep the group going." Notably, a recipient of a donation can not donate it again, so donations do not circulate. If many participants refuse to donate their surplus because they think it more important to keep it for emergency labor, this will not affect the group in the mean because the deficit for others would more or less be evenly distributed and the earnings count relatively (as weights).

In more detail, client c would need $\hat{f}_{Nc}$ but that amount is not granted because it consists of $\hat{f}_{hc}$ of h who may collude with c. Instead, every client c receives an equal *initial grant* $B_c^{(0)} = \hat{f}_{NN}/n$. (It does not depend on c but the suffix c distinguishes $B_c^{(0)}$ from the profile or vector $B^{(0)}$.) Grants redistribution, contribution to the fund, and challenges are detailed as follows.

3.2.1 Grant Redistribution

Any client c for whom the initial grant $B_c^{(0)}$ will be sufficient to pay his or her assistants, can give away part of the surplus $B_c^{(0)} - \hat{f}_{Nc}$ (which c will not be needing) to members d who have too little a grant to pay all their assistants from, that is, who have a deficit $\hat{f}_{Nd} - B_d^{(0)}$. The resulting amount of effort index is the *grant*. For d, it is denoted $B_d^{(1)}$ or $B_d^{(2)}$ and so on, as it results from the initial grant and subsequent donations. For c, the numbering is $B_c^{(2)}$ or $B_c^{(3)}$ and so on because $B_c^{(1)}$ will be the result after c contributed to the fund, as described in the next paragraph. (Probably, d does not contribute to the fund.) Notably, non-clients receive no initial grant but they may receive donations in as future attestors.

Let P_c be the amount of effort that c would have to donate from his or her grant to intermediaries m (for instance, bakers) on the basis of the estimation of total effort that each m and his or her personnel (employees) must make for clients such as c. (The 'P' is for 'price') Part of $\hat{f}_{Nc}$ is for P_c, for which $\hat{f}_{Nc}$ may suffice or not. The estimation of P_c is based on the estimation of effort by m and his or her employees, and consists of the following: 1. global set-up effort, 2. per-type set-up effort (for each service type, such as production of various types of goods) and 3. individual effort (per person or per goods item, depending on the order). Some competition between the intermediaries may make for a true "price" but there may also be collusion amongst these intermediaries, just as for quotations. Nevertheless, P_c is spelled out publicly so c may judge whether it is reasonable. Section B.2, p. 27 describes the estimation of effort and its division amongst the clients.

These donations are defaulted (or proposed) automatically as in Section B.1, p. 26, which is a heuristic to minimize the number of donations. Members having surplus grant may refuse these proposals for donations if they judge the recipient not worthy of the donations, for instance, when the assistants of the recipient (the client who would receive the grant) are flagged as suspect. (In case of identity fraud, at least the initial grant $B_c^{(0)}$ would be "earned" by a mock assistant h, to whom goods may be allocated, but h would not be able to fetch them because he or she can not prove their identity to whoever distributes the goods. Notably, nobody can transfer earnings to someone else.) An important restriction is that donors may not seek recipients other than the ones proposed, so as to coordinate the donations, for example, to avoid that someone receives twice the needed effort index from two donors who are unaware of each other's donations.

More detailed design considerations are in Section F, p. 126.

3.2.2 Contribution to Fund

Additionally, clients may also donate some of their initial grant to the (anti-collusion) fund, from which assistants are paid without anyone judging whether the payment is justified. The fund has the benefit that assistants who strategi-

cally overestimate their effort (whether colluding or not) will see part of their overestimation available as an extra payment for everyone (although proportional to their estimate to a certain extent) so without all benefits of overestimation when a particular client will pay the overestimated work. However, clients should also receive initial grants and be invited to donate them so that they can judge whether the recipient will pay a realistic effort as estimated (or "estimated") by the recipient's assistants.

Let c transfer T_c of the initial grant $B_c^{(0)} = \hat{f}_{NN}/n$ to the fund, so $F = T_N$. Let $\pi_c := T_c/B_c^{(0)} = nT_c/\hat{f}_{NN}$ be the fraction of the initial grant that goes to the fund. This fraction will be the default for later cycles, adapted whenever the client chooses a new T_c different from later $\pi_c B_c^{(0)}$. Suppose π_c is such a default from a previous cycle (or, as a check, from this cycle). Then $B_c^{(0)}$ changes to $B_c^{(1)} = (1-\pi_c)B_c^{(0)}$. (This numbering is only for sake of exposition.) If $p := \pi_N/n$ is the *mean fraction*, then $B_N^{(1)} = (1-p)\hat{f}_{NN}$ and $F = p\hat{f}_{NN}$, as should be: $\hat{f}_{NN} = B_N^{(1)} + F$.

This can also be conceived as if everyone "votes" to have $1-\pi_c$ of $\hat{f}_{NN}$ be (equally) distributed as grants and π_c of $\hat{f}_{NN}$ to be added to the fund. The mean "vote" is p so $(1-p)\hat{f}_{NN}$ is for the grants and $p\hat{f}_{NN}$ goes to the fund.

How much to contribute to the fund? There are the following considerations when selecting π_c. If the size of the fund could be determined objectively ("by nature") then it would be a bound to overreporting because a participant who overreports diminishes the probability that any fund is left for unexpected emergency work, which nobody would be willing to do without sufficient payment. (The group may be large enough to host all kinds of professions who could carry out the emergency work, but participants from other groups may also do this job.) However, the fund is determined by the participants themselves, so other considerations apply, as follows.

Fund advantages

Frustrated collusion If an assistant overestimated effort in order to collude with a client, the fund is increased. This increase allows other assistants to overreport their effort, thus frustrating collusion.

Security Clients (including intermediaries) do not want to depend on donors to pay, particularly when producing in advance. The fund supplies additional effort index to pay assistants from. Notably, intermediaries can cover most of the expenses to their personnel from donations, as determined by their "prices" of goods and services, that is, the estimated effort after division per total set-up, per-type set-up, and per-item set-up.

Futile common overreporting If everyone overreports the estimate of his or her work, $\hat{f}_{iN} > f_{iN}$, say by a factor 2, in order to increase the fund $\hat{f}_{iN}$ (the group bound) then nothing is gained because all earnings (paid from the fund) are counted relatively, so the factor 2 disappears. Such untruthfully overreporting is risky because inspections

and judgments (such as suspicion) may reduce possible payments and give a bad reputation. See, however, free riding below.

Fund disadvantages

Free-riding If all but one person truthfully report their effort estimate, that one person can free-ride by overreporting estimates as the only person. For, if a colluder is willing to pay the quasi-efforts, so that $\hat{e}_{hN} \approx \hat{f}_{hN}$, then (as is easily seen) the weight $\hat{w}_h = \hat{e}_{hN}/(\hat{e}_{hN} + z)$ is greater than $w_h = e_{hN}/(e_{hN} + z)$ where $z = \hat{e}_{N\setminus\{h\}}N$ is the sum of the reported efforts of the rest and $\hat{e}_{hN} > e_{hN} \approx f_{hN}$. In conclusion, everyone would overreport estimates, although there is no gain in the absolute sense, unless there is enough threat of inspection and judgments, as in the previous item.

Malicious effort overreporting Someone may overreport efforts only to have the fund exhausted and thereby diminish the payment of reported efforts from the fund.

Grant advantages

Inspections The owner of the grant judges whether payment are justified based on inspections or only suspicion. If not, reputation loss and less payment, though with some compensation from the fund.

Reluctance to pay The owner of the grant will want to keep some of the grant to pay unexpected emergency work, so he or she is reluctant to overreport as part of collusion.

Sensitivity Each grant is smaller than the fund so someone who overreports effort has a greater loss than when relying on the fund, and therefore reports more truthfully.

Grant disadvantages

Incomprehensibility Participants may not realize that donations are in their own interest and think that keeping the grants is profitable. As said before, the deficit for the rest of the group may be spread, so that little is lost.

Carelessness There is hardly any risk that the assistant who overreports needs any unexpected emergency work to be paid from the same grant.

Dependency Employers who have many employees depend on donations as far as these donations are not based on orders or based on the "pricings" P_c.

If these considerations lead to an unpredictable mix of grants and fund, truthful reporting may be the most profitable strategy.

3.2.3 Challenging a Grant

Finally, if someone suspects that the requested effort index $\hat{f}_{Nc}$ of some attestor c is too large, then he or she may challenge c and claim the contended part of $B_c(k)$ for some k to pay the assistants of c himself or herself. Alternatively, someone who is reluctant to donate to some attestor c may offer to pay the assistants of c himself or herself. Details are in Section B.3, p. 31.

3.3 Payment of Earnings

Once an assistant h has exerted effort e_{hcs} for attestor (typically, client) c and service s then the assistant reports effort $\hat{e}_{hcs}$ to c. The amount $p\hat{e}_{hcs}$ is to be paid from the fund F as $f(p\hat{e}_{hcs})$ for some function f. If the fund is large enough, f is the identity function, otherwise it is described below. The rest $q\hat{e}_{hcs}$ is to be paid by c from the grant of c, where $q := 1 - p$. The grant to be used is labelled by the service (see the set S above). Assume c wishes to pay r_{hcs} instead of $q\hat{e}_{hcs}$, or identical to it. (The letter 'r' is for remuneration.) The actual payment from the grant is the effort index $g(p_{hcs})$ for some function g similar to f. The assistant adds these payments to his or her earnings and the grants of c for the cycle is reduced by the payments. Notably, grants from which all corresponding services are paid may still contain effort index but these grants are of no further use and may be deleted.

Finally, a word about what happens when grants or the fund do not suffice to pay the effort indices indicated above. If the fund does not suffice, $p\hat{f}_{hN}$ is a *claims guarantee* in the sense that a reported effort $\hat{e}_{hcs}$ ("claim") when below the claim guarantee is paid in full and when above it, paid only partially, proportional to the difference between claim and guarantee. (See proportional assignment with guaranteed claims in Section D.5, p. 77.) Similarly, if the grant B_c does not suffice to pay all assistants h (such as employees) of c, then the claims guarantee is $p_c\hat{f}_{hc}$ for $p_c := B_c/\hat{f}_{Nc}$. Again, any r_{hcs} below the guarantee is paid in full, any above it proportionally to the difference between r_{hcs} and the guarantee. Notably, both for funds and grants, the claims guarantees add up to the total available, F and B_c, respectively.

3.4 Trade between Groups

If somebody requests a good from his or her group, then he or she must submit part of his or her earnings as a bid to the allocation algorithm. The higher the bid, the higher the probability that the allocated amount is close to the desired or needed amount. Now suppose participant X is from group G and Y is from H. Both worked for someone from their group. However, X wants a good from group H, for which he or she did not work. Vice versa, Y desires something from G, for which he or she did not work either. If the requested amount of goods and the efforts are the same, then there is no difference pretending that

X worked for H and Y worked for G, that is, as if they worked for the groups they want goods from.

More generally, participants request goods from groups, including one's own group, as follows. First, they indicate which earnings obtained from a group they are *not* going to use as a bid for obtaining goods from that group. These earning are *slots* for others to use. Second, they divide the earnings they want to spend over the types of goods (and add a description of the good, but that is of no importance here). For each type of good, they indicate the group they want the good from. Any bid for a good from one's own group is processed unconditionally. Now for requests from groups one is not member of. To anticipate that insufficients slots are available, participants indicate a second group where they would like to submit the remainder of the bid for a particular goods type. This is the second choice. Similarly, they may define a third choice, and so on. These choices are a default for periods to follow, so participant may specify these preferences once and if needed, adjust them. An algorithm matches slots to bid request and determines the bids that participants can submit to a group they insufficiently worked for.

In conclusion, trade is possible but it will be limited to a certain extent. For implementation, see Section C, p. 33, which also refers to design considerations.

3.5 Allocation of Goods

A request can be a need or a want in the sense of something desired. A *need* for goods is an amount of goods below which there is no reasen to participate. A *want* to obtain a certain amount of a good is a most preferred amount. Wants-based and needs-based allocation are treated in the next two paragraphs.

3.5.1 Wants-Based Allocation

For a particular goods type, participants enter the most prefered amount of the good (which may be in whole numbers, if necessary). A most preferred amount exists. (For, the more one requests, the more the producer and others will earn, therefore be able to bid more, so to keep up with them, one would also need to work harder.) Participants also enter their bids (for trade, these are the honored bid requests) which consist of a part of their earnings, and optionally, a minimum amount of the goods (if the allotment would be below this amount, then nothing is allocated). A participant does not know other participants' preferences or bids, nor the total amount of goods to be allocated. There is no procedure to allocate goods which only come in packages, such as bags of 10 and 20 kilograms or boxes with either 10 or 20 items. In other words, for now, such goods should be unpacked.[1]

[1]Further reading: Makoto Hagiwara, Goro Ochiai, and Hirofumi Yamamura (April 2026) On strategy-proofness and single peakedness: A full characterization. *Mathematical Economics*, article 103215, Volume 123. `https://doi.org/10.1016/j.jmateco.2026.103215`

The allocation algorithm is rationing along fixed-paths,[2] which is here called *fixed-path rationing* or the *fixed-path auction* because bids influence the allocation. For divisible goods, it is the weighted gains allocation, where the weights are the bids scaled such that they sum to 1. The requests for an amount of goods may be thought of as being divided by the weight (if everyone worked equally hard, the weight is the number of hours one is willing to bid). The algorithm serves the participants with the lowest such fraction first, then the next higher fraction, and so on. For indivisible goods, the allocation is a weighted gains where a certain function that processes the weights is rounded to the nearest integer. Contrary to the case of divisible goods, the allocation may assign an additional unit to an arbitrary participants, as when two participants equally deserve three items. The fixed-path rationing is such that given the bids and the requests by others, misreporting the preferred outcome does not improve the outcome. Strategic bidding does not seem possible either.

The allocation handles the minimum amounts as follows. If, while processing, an outcome drops below the minimum, the allocation removes that participant (who gets nothing) and resumes with the ones who did not get their request. If another outcome is below the minimum, it repeats this procedure until all participants have been processed.

It will often happen that participants could have made an ideal bid, that is, a lower bid that would have yielded the same amount of goods. The difference between the actual bid and the ideal bid (the surplus) is returned to the participant for later use.

3.5.2 Needs-Based Allocation

For need-based allocation, a procedure called *proportional relief of needs* is used, preferably for goods that everyone in the group needs (otherwise, claims splitting allows for strategic behavior). The procedure works as follows. Each participant reports (or misreports) his or her need, that is, the amount of goods below which any allotment would not be useful. The only allotment below the need is zero. Also, every participant submits a part of his or her earnings as bid. Participants are ordered by the fraction of his or her need and bid, from lowest to highest. Tie breaks in the order are resolved randomly with equal probabilities. When there are no ties, the participant having the lowest fraction gets his or her need first, next comes the participant having the one but lowest fraction, and so on, until the endowment no longer suffices to relief the remaining participants, who get nothing. The remainder of the endowment is distributed to those who have been relieved, namely, proportional to their needs, so the procedure is efficient. Anyone who asks more than needed increases the risk to get nothing, so everyone is encouraged to report his or her true need. No surplus bids are returned, as for fixed-path rationing. The procedure works for divisible and indivisible goods, but for the latter, it may not be exactly proportional. For implementation and details, see Section D.3, p. 67.

[2] Hervé Moulin (1999) Rationing a Commodity along Fixed Paths, *Journal of Economic Theory*, vol. 84, pp. 41-72. `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=102615`

Chapter 4

Questions

In a nutshell, the question is whether to proceed and if so, how. In more detail:

1. General questions.
   (a) Is developing an alternative economy such as Eranism still of any use?
   (b) Which organization could develop Eranism? Would it be possible to make money with it?
2. Questions about the foundations.
   (a) Can registering the effort, $\hat{e}_{hc}$, be made strategyproof other than by imposing bounds? Classical principal-agent or screening theory[1] approaches require some kind of payment (but money is undesirable) from unbounded reserves (which is unrealistic) and rely on a prior probability of the effort (which seems impractical).
   (b) Can reporting of the estimated effort ($\hat{f}_{hc}$ as in Section 3.2.1, p. 15) be made less vulnerable to collusion than the currently employed inspection-based methods? Classical mechanism design[2] that reveals

[1] Let $w(\epsilon, z) := \epsilon/(\epsilon + z)$ be the weight in the weighted gains allocation (a fixed-path rationing) where ϵ are the earnings and z is the sum of other participants' earnings. The valuation by assistant h is $v := w(\hat{e}_{hN}, z) - c_h(e_{hN})$ where c_h some cost function that reflects the real effort and, as usual, e_{hc} is the effort by h for client c and $\hat{e}_{hc}$ its report by h. The type $\theta := e_{hc}$ is a fact given by nature: the minimum effort to do the job. What "price" t (where $t \leq 0$) would h be willing to pay only for recieving his or her earnings? So that the utility $v + t$ of h makes h reveal the true type? Are these payments without bound? What probabilistic information about θ is available?

[2] Assistant h who forecasts effort f_{hc} to make for client c would have valuation $W_h(e) := w(\hat{e}_{hN}, \hat{e}_{N\setminus\{h\}\,N}) - c(f_{hN}) = \hat{e}_{hN}/\hat{e}_{NN} - c(f_{hN})$ when $f_{hN} \approx e_{hN}$. Without collusion, $\theta = f_{hN}$ is a type given by nature. A Groves mechanism would then find alternatives $a = (a_{hc} \mid (h, c) \in N^2)$ that maximizes $\sum_h W_h(a) = \sum_h a_{hN}/a_{NN} - \sum_h c_h(f_{hN})$ which however is independent of a. (Not to mention the transfer t and the vulnerability of a Groves mechanism to collusion.) Any other mechanism would seem to fail too because under collusion, $\theta = f_{hN}$ ceases to be a fact, that is, something that can be inspected or that can be revealed by some utility.

facts does not seem applicable because estimate f_{hc} is not a fact when assistant h colludes with client c. Only inspections, or the threat thereof, seem to force honest f_{hc}. Section F, p. 126 lists some trial solutions.[3]

(c) Rationing along fixed paths is used for a kind of auction, where a participant submits a bid (the weight in weighted gains) and given that bid, the participant submits his or her preferred amounts of goods, where truthful reporting of this amount is most profitable. Does an alternative kind of such a "two-pronged" auction exists where there is also a "true" weight to be submitted, not only a true preference?

3. Questions given the present set-up.

   (a) How to arrange that a group manager or other authority rations the group's supply?

   (b) How to deal with service orders (in particular, for goods production) and the subsequent increase of the total estimated labor when the service is never used, in particular, when the goods are not (realistically) applied for? This is the problem of orders for work that is done in vain, especially overproduction (unsold goods), which is also present in the monetary economy.

   (c) What if clients refuse to pay? This is the same problem as deferred payment of money for services, where enforcement of private law and loss of reputation are to little avail.

   (d) What is an incentive to maintain goods and recycle them? So that they need not be reclaimed? Would individual objects have to be stored for this purpose? Paying only the effort of maintaining and returning them may not be sufficient, so the effort would have to be reckoned *as if* the good would have to be produced anew, but this approach is not rooted in reality.

   (e) How to deal with unemployment? As of now, no goods are allocated to people who have no earnings, and people without work can only collude with a "client" to "work" for or with an "assistant" to become recipient of an initial grant or donations. Setting priorities requires some kind of authorization.

Implementation details (including proofs of properties) and design consideration have been mentioned in the table of contents but are still begin edited.

[3] Further reading: Mustafa Oğuz Afacan and Inácio Bó (Oct. 2022) Strategy-proof popular mechanisms. Journal of Mathematical Economics, Article 102734, Volume 102. `https://doi.org/10.1016/j.jmateco.2022.102734`