Eranism: a Transparant Economy

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Abstract

This is the design of Eranism, an economy that allows for the reduction of pointless work, for more prudent use of natural resources, a wasteless and mostly fair distribution of goods, and an appeal to the human propensity to cooperate. 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 reality and therefore does without money. To complete the design, a few questions remain to be answered.

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Chapter 1

Introduction

This document describes an economy called Eranism that 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, as truthfully reported by people. Truthful reporting need not be a matter of ethics but can be encouraged by the rules of the economy, as will be the case here.

Eranism is based on a state of affairs that includes the efforts made, the predicted effort, the amount of goods present, and the desired or needed amounts of goods. Also, this economy allows for mostly fair distribution of goods and for reasonable remuneration of effort. It does not use money, which only is an indirect account of reality. The economy should run as a single computer system 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 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 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 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.[1] 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.[2] 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.[3] 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 recent milestone reached by Elon Musk, who in June 2026 became the world's first trillionaire.[4]

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.[5]

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.

1.2 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 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,

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

[2] Section 78.

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

[4] 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/`

[5] 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.

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. Candidate assistants 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. 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. The donors will judge whether the recipient's grant would not become too large, but others can also challenge the height of grants, as will be explained in more detail in the main text.

When the time has arrived to allocate the goods that members requested, the 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.

1.3 Outline

Chapter 2 introduces some concepts of Eranism and Chapter 3 tells how they are processed. Questions are in Chapter 4 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. Each *allocation* 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 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). 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. 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* $m_{\tau u s \ell}$ 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. 4.) 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, they can collude to let higher grants be created, as will become clear in Section 3.2, p. 11.)

Design considerations and backgrounds of effort are in Section E.4, p. 81 and those of grants are in Section E.6, p. 85.

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. 5 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. 9. 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 followin steps, many of which are defaulted or automated. First, for a particular topic (good, service), he or she may do the following at any time in the order indicated.

Request of services A future *client* requests candidate *assistants*, possibly not from his or her group, to render a service in a particular time interval. If the assistant is a producer of a desired amount of goods then the client is also called *customer*.

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 Basing themselves on the service requests, candidate assistants make quotations: They estimate the end date, duration, and maximum labour time of the kind of work, that is, the effort, as set out in Section 3.1, p. 10. Anticipated effort is not estimated but specified retrograde.

Selection of quotation The client selects a single assistant to render the service or rejects all quotations.

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 candidate assistants to produce a certain 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 Clients collectively determine (without deliberation) the grants that are labelled by this cycle, that is, the amount of effort index from which they pay assistants (register their effort) whose work 1. started before this cycle and is expected to end during this cycle or 2. both started and was expected to end in the previous cycle, that is, the work could not yet be seen when determining the grant during the previous cycle as a number 1 case. The assistants are paid from the grant of this cycle once the work indicated by 1 or 2 is finished. The grants of a cycle add up to the total estimated effort index of this work. The details are explained in Section 3.2, p. 11.

Continuing for a particular topic, participants now do the following.

Payment of earnings Once work is done, an attestor pays the effort (as reported by the assistant) from the designated grant. The payment diminishes the grant: see Section 3.3, p. 12.

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. 12.

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. 13 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 estimated effort f_{hcs}.

Design considerations see Section E.5.

3.2 Redistribution of Grants

For a given grant cycle, let S be the collection of services that are expected to end during this cycle or that started and were expected to end during the previous cycle. For assistant h and attestor (typically, client) c let $\hat{f}_{hc} := \sum_{s \in S} \hat{f}_{hcs}$ be computed at the start of the cycle. For group N, the total reported effort by h for all attestors i of h is $\hat{f}_{hN} = \sum_{i \in N} \hat{f}_{hi}$ where undefined $\hat{f}_{hi}$ are skipped, that is, only terms for attestors of h are summed. (This summation convention is used in the sequel.) Notably, unplanned labor, such as for an unexpected emergency, is to be included in f_{hN}.

When all work for attestor c is completed, c would have to pay from a grant $\hat{f}_{Nc} = \sum_{i \in N} \hat{f}_{ic}$ but other group members have to accept this amount, as follows. Initially, to every attestor c of a group N is allotted the same grant $B := \hat{f}_{NN}/\#N$ (independent of c) where $\hat{f}_{NN} = \sum_{h \in N} \hat{f}_{hN}$ is the reported effort estimate for the group and $\#N$ is the number of group members. In other words, to each member is granted the mean effort to begin with. Any attestor c for whom this grant will be sufficient to pay his or her assistants, can give away part of the surplus $B - \hat{f}_{Nc}$ (that 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 $\hat{f}_{Nd} - B$. The donations are defaulted automatically as in Section B.1, which is a heuristic to minimize the number of donations. Members having surplus grant may overwrite these defaults (refuse these proposals for donations) if they judge the recipient not worthy of the donations, for instance, when the assistants of the client who would receive the grant are flagged as suspect. (In case of identity fraud, at least the initial grant B would be "earned" by these mock assistants, to whom goods may be allocated, but they would not be able to fetch them because they can not prove their identity to whoever distributes the goods.)

For a potential donor to judge how much a future recipient would need as a grant, the size of the grant can be computed from the number of people working for the prospective recipient, the set-up time, the time needed for individual services such as production of one item, and so on. These computations are described in Section B.2

Additionally, 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 G_c 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.

Members must complete this redistrubition before the end of the grants cycle. These transactions are donations because nothing needs to be expected in return directly, but they 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." Without the above grants redistribution, assistants could easily collude and create their own income "out of thin air," for example, by offering each other quotations and register the "work" afterwards. Whether this can be avoided depends on whether a potential donor judges that recipients will collude, or otherwise depends on the colluders to be challenged. Notably, clients do not want to depend on donations to pay their personnel, particularly so when producing in advance. More detailed design considerations are in Section F, p. 112.

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. Suppose c wishes to pay (register effort) p_{hcs}. The grant to be used is labelled by the cycle when the service was expected to finish. The actual payment, that is, the effort e'_{hcs} to be registered, is computed from the intended payments p_{hcs} and the grant, proportionally to the exerted effort $\hat{e}_{hcs}$ but such that, if possible, the expected effort $\hat{f}_{hcs}$ is guaranteed. The assistants add these payments to their earnings and the grants of c for the various cycles are 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. For the proportional assignment with guaranteed claims see Section D.5.

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. 26, 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]

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

[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`

[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`

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, which 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. 57.

Chapter 4

Questions

In a group, people know that they may not know what others know about them. Therefore, in order to protect their reputation, they will be reluctant to manipulate the economy. This phenomenon has been used to suppress most manipulation but some questions remain to be answered:

1. Can estimation of the effort (hence, grants) be made less vulnerable to collusion than it is now? See the creation of one's own earnings "out of thin air" at the end of Section 3.2, p. 11. It's not about revelation of preferences (which are arbitrarily large under collusion) but of objective reality as reported by participants. Also, letting earnings flow back as grants has no basis in reality and would be a return to money. In Section F, p. 112 are trial solutions.[1] A self-contained problem statement that gives some design considerations is the separate document entitled 'The Grant-Estimation Problem'.

2. 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. How to deal with unemployment? As of now, no goods are allocated to people who have no earnings. Setting priorities requires some kind of authorization.

4. How to arrange that a group manager or other authority rations the group's supply? Or is rationing a purely political issue?

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

[1] 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`