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Quantifying redistribution by public institutions in ancient Athens and Rome

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Abstract

Reconstructed social tables have transformed the measurement of premodern inequality but say little about what public institutions did to it. We develop a historical fiscal incidence approach that combines these reconstructions with documented fiscal rules, adapting the microsimulation methods used to evaluate modern welfare states. Applied to late-Classical Athens and second-century Rome, it shows that both civic traditions reduced inequality through distinct channels: taxing the rich in Athens, feeding the plebs in Rome. Athenian elite obligations mainly financed warships and festivals and lowered the Gini coefficient by about one point, at most 1.4 when these goods are valued as equal per-capita benefits. Rome's grain and cash distributions, financed by resources extracted across the empire, lowered urban inequality by nearly five points, comparable to the lower range of modern tax-benefit systems, and at an equal budget share about as much as Alaska's oil dividend. Redistribution thus depended less on political voice than on the volume and form of resources reaching households.

Introduction

The absence of a welfare state does not imply the absence of redistribution. Ancient states imposed heavy obligations on wealthy households and delivered cash, food and public services to broad segments of the population. The question is therefore not whether ancient Athens or Rome had a welfare state, but how much their public institutions changed the distribution of income, through which instruments and for whom.

A growing quantitative literature has shown that ancient inequality can be measured without household surveys. Social tables, which combine the size and average income of social groups, have been used to reconstruct income distributions for pre-industrial societies and to measure how much of the available surplus elites extracted[1]. Such reconstructions now exist for the Roman Empire[2], for regions of the Roman and Han empires[3] and for classical Athens[4,5], alongside estimates of wealth inequality for Athens and Hellenistic Delos[6,7]. Historians, for their part, have long documented the fiscal institutions themselves: the burden of liturgies on the Athenian elite and the dominance of military expenditure in Athenian public finance[8–10], and the organization, recipients and provincial financing of Rome's grain distributions[11–14]. The two literatures have nonetheless remained largely separate. Inequality estimates are computed on gross incomes, and institutional studies do not translate fiscal rules into distributional outcomes. Ober, for instance, estimates a pre-tax Gini coefficient for Athens and argues that inequality after taxes "was lower yet", without quantifying the difference[5]. To our knowledge, no study has measured how much an ancient public institution changed income inequality.

We bridge this gap by bringing to antiquity the tool that public economists use to evaluate modern redistribution: tax-benefit microsimulation[15,16]. Modern microsimulation applies statutory rules to survey microdata. Ancient societies offer no microdata, but they do offer two

kinds of evidence that can be combined in the same logic: reconstructed social tables, which describe who earned what, and documented fiscal rules, which describe who paid and who received. We turn social tables into synthetic populations, assign each obligation and entitlement to the households that bore or received it according to the rules attested in the sources, calibrate amounts to historical budgets and recipient numbers, and compare inequality before and after. This historical fiscal incidence framework makes explicit every assumption linking sources to outcomes, isolates the contribution of each instrument, and supports the counterfactuals that are routine in modern policy evaluation (alternative financing, coverage or budgets) but have not been applied to premodern states. Because social tables exist for many premodern societies, the approach can be transposed well beyond the two cases studied here.

We apply this framework to late-Classical Athens, around 330 BCE, and the city of Rome in the second century CE. Both are among the best-documented economies of the ancient world, with quantitative reconstructions of income distributions and extensive evidence on fiscal obligations and public entitlements. Their institutional contrast makes the comparison informative: Athens financed warships and festivals through compulsory contributions from wealthy citizens, whereas Rome distributed grain to registered members of the urban plebs.

Both systems reduced inequality, but through different channels and on different scales. In Athens, the Gini coefficient among all residents fell from 0.394 to 0.385, about four-fifths of the reduction coming from elite financing of the fleet and festivals; valuing these collective goods as equal per-capita benefits raises the reduction to at most 1.4 points. In Rome, grain and occasional cash distributions lowered the Gini coefficient of the urban population from 0.442 to 0.394, a reduction of 4.8 points or 10.8%. This effect is comparable to the least redistributive modern tax-benefit systems and, once program size is equalized, to Alaska's oil-funded dividend: like that

dividend, Roman grain was financed largely from resources generated outside its beneficiary population.

Results

Two civic fiscal systems

Athenian democracy linked participation in government to a sharply bounded civic body. Political equality among male citizens coexisted with large economic differences and with the exclusion of women, metics (free resident non-citizens) and enslaved people from formal participation[5]. Athens had no progressive tax on annual income. Its main direct obligations were the *eisphora*, an episodic levy assessed on wealth, and liturgies, which required affluent households to finance particular public functions: the trierarchy supported warships, and festival liturgies financed civic and religious performances[8]. Warfare was by far the largest item of Athenian public expenditure[9]. We use Ober's fiscal envelope of 67 talents for the trierarchy (a 100-ship deployment), 25 talents for festival liturgies and 10 talents for an ordinary *eisphora*[5]. Metics also paid the *metoikion*, a fixed residence tax of 12 drachmas per man[17,18]. Two cash benefits complete the account: a disability allowance of two obols a day for citizens unable to work and owning less than three minas[19], and festival payments (*theorikon*), whose amount and coverage are less precisely documented[20].

Imperial expansion had reduced Rome's reliance on direct taxes paid by its citizens[21]. Under the Principate, the city's residents paid indirect duties and a tax on inheritances[22,23], whose bases cannot be attributed to households from an income schedule. The main redistributive instrument was the grain ration (*frumentatio*). A monthly ration of five *modii* is attested by the 70s BCE[24], distributions became free in 58 BCE, and Augustus fixed the number of recipients at about

200,000[25,26], a scale again recorded in 202 CE[11]. Access depended on citizenship, registered residence and age, not on income: the distributions favored a privileged section of the citizen body rather than the poor as such[11–13]. Emperors also made occasional cash distributions (*congiaria*) to the urban plebs. The grain itself came from provinces, through the imperial fiscal and provisioning system[14,23]. Table 1 summarizes the instruments, their historical parameters and how we implement them.

Athens: heavy elite obligations, modest redistribution

Among all residents of Attica, the Gini coefficient falls from 0.394 to 0.385, a reduction of 0.91 points or 2.3% of initial inequality (Fig. 1). The effect is larger within the civic body: 1.31 points (3.1%) among free residents and 1.71 points (4.4%) among citizens, reflecting the concentration of obligations and cash benefits among citizens. Changes in resources are small across the distribution, with a loss of about 4% for the top decile and gains below 1% at the bottom (Fig. 2). An exact Shapley decomposition attributes 0.54 points to the trierarchy and 0.20 to festival liturgies, together about four-fifths of the total; the *eisphora* adds 0.08 points and the two cash benefits 0.11 (Fig. 3). The *metoikion* slightly increases inequality, because a fixed payment weighs more heavily on poorer metic households.

Athenian redistribution thus operated through who paid rather than who received, and most of the revenue financed collective goods rather than transfers to households. Following standard fiscal incidence practice, the reference estimates do not value these goods. Allocating the festival budget equally across residents raises the reduction to 1.04 points; allocating the festival and trierarchy budgets together, 92 talents or 1.28% of mean income, raises it to 1.40 points. Even this upper bound remains small.

Rome: an externally financed transfer to the urban plebs

The Roman reconstruction starts from a higher initial Gini of 0.442. Grain provision alone reduces it by 4.42 points; adding the annualized *congiarium* lowers it to 0.394, a total reduction of 4.79 points or 10.8% (Fig. 1). The effect is large because the ration was substantial (about 393 kg of wheat a year, roughly one person's subsistence) and reached an estimated two-thirds of households below the top decile. Mean resources rise by about 40% in the bottom decile and by 12% in the ninth (Fig. 2). Because the grain was financed by imperial resources rather than by taxes on urban residents, the Roman estimate measures the distributional effect of a transfer entering the city, not redistribution among its residents.

Robustness to historical uncertainty

Historical reconstructions involve uncertain parameters, so we vary each key assumption in turn (Fig. 4). These scenarios are alternative accounting choices, not sampling confidence intervals. The Athenian reduction stays between 0.82 and 1.01 points across alternative within-group dispersion, cash-benefit calibrations, an additional extraordinary *eisphora* and an alternative imputation of disability eligibility. In Rome, it remains close to five points under the pessimistic version of the income schedule (5.37), doubled top-decile incomes (4.64) and a reweighting of the schedule to large-city population shares[3] (5.14). It depends mainly on coverage: 3.29 points with 150,000 recipients and 6.47 with 250,000, while extending receipt to all income ranks gives 3.63. Spreading the cash budget over all households barely changes the result (4.87). Charging half or all of the grain budget to the city's richest decile, a counterfactual, would raise the reduction to 7.57 and 10.63 points. Finally, removing the within-group interpolation, which the sources do not provide, changes the Athenian reduction from 0.91 to 0.88 points and the Roman

one from 4.79 to 3.99: interpolation affects levels but does not generate the contrast between the two cities.

Ancient redistribution in modern perspective

To gauge magnitudes, Fig. 5 places Athens and Rome alongside measured redistribution in the 27 EU countries and nine non-EU countries[27–29]. Before redistribution, Athens lies in the upper part of the European range (0.385 on the modified-OECD scale), whereas Rome lies above every EU country, close to Australia (0.441), and close to or above Argentina (0.538) under the alternative urban reconstructions. Athens' reduction of 1.07 points on the same scale is below every modern comparator, and even its 1.40-point upper bound is half the smallest modern reduction (2.8 points, in Bulgaria and Hungary). Rome's 4.79-point reduction exceeds those of Bulgaria, Hungary and Chile (4.3), is close to Slovakia (4.9), and remains below the EU median (7.7). Modern estimates cover complete tax-benefit systems, so these comparisons show how much a few civic instruments achieved relative to whole fiscal systems. Collapsing each modern distribution to ten decile means, to mimic the coarseness of ancient sources, lowers modern reductions by 1.2 points on average but leaves this ranking intact (Supplementary Fig. 2). Because Roman grain was financed from outside its beneficiary population, a resource-funded entitlement provides a closer benchmark. Removing Alaska's Permanent Fund Dividend, a universal cash payment financed by oil revenue, would raise the state's per-capita household-income Gini from 0.44 to 0.46[30], about half the raw Roman grain effect. But Roman grain absorbed about 10.8% of the city's reconstructed income, against 4.09% of Alaskan household income for the 2019 dividend[31,32]. Scaling the Roman grain budget down to the Alaskan share, with the same recipients and allocation rule, reduces the Gini by 1.98 points, the same magnitude

as the Alaskan effect. Most of the difference in raw effects therefore reflects program size rather than a more redistributive allocation rule.

Discussion

Athens and Rome show that civic institutions could measurably reduce income inequality long before the welfare state, through different channels: taxing the rich in one case, provisioning the urban plebs in the other. In both cities, political membership determined who contributed and who benefited.

These results bear on three debates. First, they qualify the view that redistribution is essentially modern. Lindert shows that public social spending was below 1% of GDP in Britain, Germany, France and the United States as late as 1880, and that its growth accompanied the extension of political voice[33]. Some premodern institutions did achieve measurable redistribution, but not in the order the voice hypothesis would predict: democratic Athens redistributed little, whereas imperial Rome redistributed substantially because civic membership gave access to resources drawn from an empire. Second, they speak to Scheidel's argument that large reductions in inequality have historically required violent shocks[34]. The modest Athenian effect is consistent with that view and operated mainly through the financing of war; the Roman case shows that a peacetime institution could reduce urban inequality by several Gini points, but only by channeling an empire's fiscal resources into a single city. Third, they provide a quantitative test of Ober's claim that Athenian democracy further equalized incomes through taxation of the rich[5,35]: the direction is confirmed, but the magnitude is small. Whether it counts as substantial depends partly on whether pay for civic and military service is treated as redistribution, as in Ober's account, or as earned income, as in standard fiscal incidence analysis.

What mattered was less the political regime than the fiscal base available to civic entitlements and the form in which resources reached households. Athens redistributed within its civic community, drawing on its own elite's resources and spending most of them on collective goods; Rome redistributed toward its civic community, drawing on resources extracted across an empire. The Roman case thus resembles modern resource-funded transfers more than tax-financed welfare states, and its equalizing effect within the city is the counterpart of extraction elsewhere.

Our estimates rest on reconstructed distributions and explicit allocation assumptions, and cover selected instruments rather than the full incidence of public expenditure. The sensitivity analyses show which assumptions matter (chiefly the number of Roman grain recipients) and which do not. Better evidence on household composition, grain registration and the income structure of the city of Rome would sharpen the estimates.

More broadly, historical fiscal incidence turns social tables, now available for many premodern societies, from descriptions of inequality into tools for evaluating institutions. Extending the approach to other settings, and to the financing and redistribution of resources across the territories of ancient states, would help distinguish the capacity to extract from the capacity to redistribute, a distinction central to Lindert's and Scheidel's accounts and, our results suggest, already salient in antiquity. For Rome, combining provincial taxation with metropolitan transfers would show whether urban redistribution reduced inequality or merely displaced it, a question that also arises for modern transfers financed by natural resources or external revenue.

Methods

Historical fiscal incidence framework

We adapt tax-benefit microsimulation[15] to settings without microdata. Each synthetic record carries an initial income, a population weight and, where available, household size and legal status. Documented fiscal rules are translated into liabilities and entitlements assigned to these records, with amounts calibrated to reproduce historical budgets and recipient numbers. Post-redistribution resources equal initial income minus compulsory payments plus cash and in-kind benefits, expressed per person. Where eligibility is unobserved, records are split into recipient and non-recipient parts that preserve population weights and initial incomes. The number of records (19,539 for Athens and 9,884 for Rome after splitting) reflects numerical resolution, not sample size; doubling the resolution changes the estimated Gini coefficients only in the fifth decimal place.

Athenian income distribution

We use the 34 social groups of Ober[5], which give legal status (citizen, metic or enslaved), number of households, household size and annual household income for about 227,000 residents and 43.1 million drachmas of income, about 190 drachmas per person. The printed household count of group 9 (3,750) is inconsistent with the source's totals; 4,750 reproduces them. Because the table assigns one mean income to each group, we introduce a transparent, mean-preserving dispersion inspired by ungrouping methods[36]: each group is represented by 501 equally weighted points distributed uniformly between 75% and 125% of its mean. This raises the initial Gini from 0.380 to 0.394; removing or doubling the dispersion changes the measured reduction by at most 0.05 points. Because the income of enslaved residents is better interpreted as maintenance, we

also report results for free residents and citizens; instruments are always simulated on the whole population, and only the population over which the Gini is computed changes.

Roman income distribution

We use the optimistic column of Scheidel and Friesen's income schedule for the Roman Empire in the mid-second century CE, before the Antonine plague[2], as a proxy for the city of Rome, with the pessimistic column as a sensitivity case. Incomes are expressed in multiples of gross subsistence, 390 kg of wheat equivalent per person per year. Incomes are uniformly distributed within closed brackets and Pareto-distributed in the open top bracket (shape parameter 2; 1.5 and 3 as alternatives), with 501 points per bracket. We assume an urban population of one million[37] (0.8 and 1.2 million as alternatives) and households of three persons. Because an empire-wide schedule may understate urban top incomes and overstate the share of rural subsistence households, two variants double top-decile incomes or reweight the brackets to the large-city shares used by Alfani et al.[3] (25% at physical subsistence, 17% in middling groups), keeping the elite share and the incomes within each bracket unchanged. The schedule does not distinguish legal status, so Roman results cover all residents.

Athenian instruments

Amounts are annual and expressed in drachmas (six obols to the drachma, 100 drachmas to the mina, 6,000 drachmas to the talent); an unskilled worker earned about 1.5 drachmas a day[38]. The trierarchy (402,000 drachmas) is allocated to citizen elite groups, and festival liturgies (150,000) and the *eisphora* (60,000) to all elite groups, including wealthy metics[8,18], in proportion to income as a proxy for wealth. An extraordinary ten-talent *eisphora* is a sensitivity case. The *metoikion* charges 12 drachmas to one man per metic household[17], raising 166,020 drachmas. Disability maintenance pays 120 drachmas a year (two obols over 360 days) to 500 recipients[19].

Eligibility requires assets below 300 drachmas and incapacity for work, neither of which is recorded. We assume that a household with income Y holds assets drawn from an exponential distribution with mean $2Y$ ($5Y$ in a sensitivity case), so that the probability of meeting the asset condition is $1 - \exp[-300/(2Y)]$, and calibrate the probability of incapacity among non-elite citizen households so that the expected number of recipients equals 500. Festival cash is set at three drachmas per citizen household per year (91,005 drachmas), with zero and six as alternatives; because the sources describe a payment per citizen and festival[20], this annual household amount is an explicit calibration assumption. The two cash benefits (151,005 drachmas) cost less than the *eisphora* and *metoikion* raise (226,020 drachmas), so the account is budget-compatible.

Roman instruments

Grain is assigned with equal probability to households below the initial top decile (about 300,000 households) until 200,000 rations are allocated, one per household; excluding the top decile keeps elite orders out of the plebs and is not a means test. At 6.55 kg per *modius*, the annual ration of 60 *modii* is about 393 kg of wheat, or 1.01 subsistence units, adding 0.34 units per person in a three-person household; the grain-only result depends only on this physical conversion. The *congiarium* of 400 sesterces per recipient reported for 145 CE[39] is annualized over the 23-year reign of Antoninus Pius (17.4 sesterces per recipient-year, 3.48 million sesterces in total) and converted to wheat at 2.5 sesterces per *modius*. Coin legends record nine such distributions under Antoninus Pius[40]; since the amounts and coverage of the other eight are undocumented, this is a lower-bound cash scenario. Because cash distributions could reach beyond the grain lists (Augustus reports 320,000 recipients of his *congiarium* of 5 BCE[25]), a variant spreads the same budget over all urban households. In the reference, both transfers are

financed outside the city; two counterfactual variants charge half or all of the grain's wheat value to the top decile in proportion to income. Inheritance and indirect taxes are not simulated because their bases cannot be attributed from an income schedule, and provincial taxes fall outside the urban population.

Collective goods and public pay

Following standard fiscal incidence practice, we do not impute the value of collective goods to households. Pure public goods such as naval defense have no observable individual incidence, and their allocation would require arbitrary assumptions; festivals are closer to in-kind provision, but participation by status and income is not documented. Our estimates thus measure the incidence of how public obligations were financed and of transfers received by households, not the full incidence of public expenditure. Two upper-bound variants allocate the festival budget, and the festival and trierarchy budgets together, equally per resident while keeping their financing unchanged. Urban collective goods financed by the emperor, such as games, baths and aqueducts, are likewise not imputed, so this convention does not mechanically favor Rome. Pay for civic and military service is treated as earned income, already included in the initial distribution, consistent with the treatment of public-sector wages in modern tax-benefit accounting; Ober instead treats it as a channel of redistribution[5].

Inequality measures and decomposition

We report Gini coefficients before and after redistribution, reductions in Gini points (0–100 scale) and as a share of initial inequality, and changes in mean resources by decile of initial income, holding initial ranks fixed. Supplementary Fig. 1 reports the distance between each Lorenz curve and the equality line, with households re-ranked after redistribution. For Athens, we attribute the reduction to the six instruments with an exact Shapley decomposition[41,42],

evaluating the Gini for all 64 subsets of instruments and averaging each instrument's marginal effect over all 720 orders of introduction, so that contributions sum exactly to the total (Supplementary Table 1). Reference results use per-capita household income. For comparison with modern sources, we also use the square-root scale and the modified-OECD scale, treating all household members beyond the first adult either as adults or as children because ages are unknown.

Modern comparators

European benchmarks are published EUROMOD indicators for the 27 EU member states in policy year 2025[27], comparing market income with disposable income after direct taxes, social contributions and cash benefits under the modified-OECD scale[16,43]. Seven non-EU comparators come from the OECD Income Distribution Database[28] (square-root scale; latest year with both market- and disposable-income Ginis) and Argentina and Uruguay from LATINMOD[29,44] (per capita). Because scales differ across sources, the scale is reported for each case (Supplementary Tables 2 and 3). For Alaska, the 2019 dividend totaled US$1.017 billion against US$24.843 billion of aggregate household income[31,32]; the equal-budget exercise rescales the Roman grain budget to 4.09% of reconstructed income with unchanged recipients and allocation rule. Norway is reported as an overall benchmark, without attributing any part of its redistribution to petroleum revenue[45]. To mimic the coarseness of ancient sources, we also collapse each EUROMOD distribution to ten decile means and recompute both Ginis (Supplementary Note 3).

Statistics

All estimates are deterministic accounting results computed on population-weighted synthetic records. No sampling inference is involved, and no statistical tests are performed. Uncertainty

arising from the historical reconstruction is assessed through the one-at-a-time sensitivity analyses reported in Fig. 4.

Use of AI tools

A large language model (Claude, Anthropic) was used for language editing and formatting. The author takes full responsibility for the content.

Data availability

The transcribed source social tables, the fiscal parameters and the synthetic records generated in this study will be deposited in [repository name, DOI to be added] upon publication. Modern comparators are publicly available from EUROMOD, the OECD Income Distribution Database and the cited publications.

Code availability

The code used to build the synthetic populations, simulate the instruments and produce all figures will be made available at [repository name, DOI to be added] upon publication.

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Author contributions

O.B. designed the study, performed the analysis and wrote the manuscript.

Competing interests

The author declares no competing interests.

Figure legends

Figure 1 | Main inequality estimates in Athens and Rome. Open dots show Gini coefficients before redistribution and filled dots after; connecting bars show the modeled reduction, reported in Gini points at right. For Athens, population variants change the residents over which the Gini is computed (all residents, free residents, citizens), and equivalence-scale variants change how household resources are assigned to persons; because ages are unknown, the modified-OECD cases treat every additional household member either as an adult or as a child. For Rome, the reference includes the grain ration and the annualized *congiarium*; the grain-only scenario excludes the latter. Computed on population-weighted synthetic records (Methods).

Figure 2 | Change in mean resources by initial-income decile. Percentage change in mean per-capita resources after the simulated instruments, by decile of initial income in Athens (blue) and Rome (red). Deciles are defined on initial income and held fixed. Athenian changes combine elite obligations, the *metoikion* and cash benefits; Roman changes combine the grain ration and the annualized *congiarium*.

Figure 3 | Shapley decomposition of the Athenian Gini reduction. Contribution of each instrument to the reduction in the Gini coefficient among all residents, in Gini points. Each contribution is the instrument's marginal effect averaged over all 720 orders of introduction; contributions sum to 0.91 points. Negative values indicate an inequality-increasing contribution.

Figure 4 | Sensitivity of the Athenian and Roman results. a, Athens; **b**, Rome. Open dots show initial and filled dots final Gini coefficients; bars show the modeled reduction, reported in points at right. Each row changes one assumption relative to the reference. The last two Athenian rows keep the reference financing rules and allocate the stated collective-service budget equally

per resident. The Roman local-financing rows are counterfactual charges, not historical tax estimates. These are alternative accounting scenarios, not confidence intervals.

Figure 5 | Initial and final Gini coefficients in ancient and modern comparisons. Cases are ordered by initial Gini. Athens uses the modified-OECD scale treating all additional household members as adults; EUROMOD uses an age-based modified-OECD scale, the OECD Income Distribution Database a square-root scale and LATINMOD per-capita household income. Ancient arrows cover selected instruments and modern arrows complete tax-benefit systems. The Rome arrow includes grain and the annualized *congiarium*. Norway's arrow measures redistribution by the full tax-benefit system and is not attributed to petroleum revenue. Sources and definitions are given in Methods and Supplementary Tables 2 and 3.

Tables

Table 1 | Fiscal instruments and historical parameters in Athens and Rome

Instrument	Historical rule or eligibility	Nature and historical parameter	Reference treatment
Athens, taxation			
Trierarchy	Compulsory naval financing by wealthy citizens	Elite obligation; 67 talents for a 100-ship deployment	Allocated within the citizen elite in proportion to income
Festival liturgies	Affluent sponsors financed civic and religious performances	Collective-service cost; 25 talents	Allocated within the liable elite in proportion to income
Eisphora	Episodic wealth-assessed levy, especially for military needs	Direct levy; 10 talents	Allocated to affluent households, income as wealth proxy
Metoikion	Status levy on resident foreigners; exemptions existed	Fixed liability; 12 drachmas per man	One liable man per metic household
Athens, transfers			
Disability maintenance	Citizens unable to work, with property below 3 minas	Cash maintenance; 2 obols per day	360 days, 500 recipients imputed by assets and incapacity
Theorikon	Festival payment; rate, dates and coverage debated	Conditional cash; no secure annual amount	3 drachmas per citizen household; variants 0 and 6
Rome, taxation			
Inheritance tax	5% levy on inheritances and legacies, with exemptions	Asset-transfer tax	Not applied: requires taxable estate flows
Indirect taxes and customs	Levies on sales, transactions and goods	Indirect taxation; bases varied	Not quantified: household bases unavailable
Rome, transfers			
Frumentatio	Registered urban plebs; not a poverty test	In-kind; 5 *modii* monthly; about 200,000 recipients	60 *modii* (393 kg) a year below the top decile; 150,000–250,000 as sensitivity
Congiaria	Occasional imperial cash distributions to the urban plebs	400 sesterces per recipient in 145 CE	Annualized to 17.4 sesterces per grain recipient (lower bound); variant: all households

Rules and parameter ranges precede the modeling assumptions in the final column. Pay for public service is part of initial income and is not simulated as a transfer; collective goods are not valued as household benefits in the reference (see Methods).

Figures

Figure 1

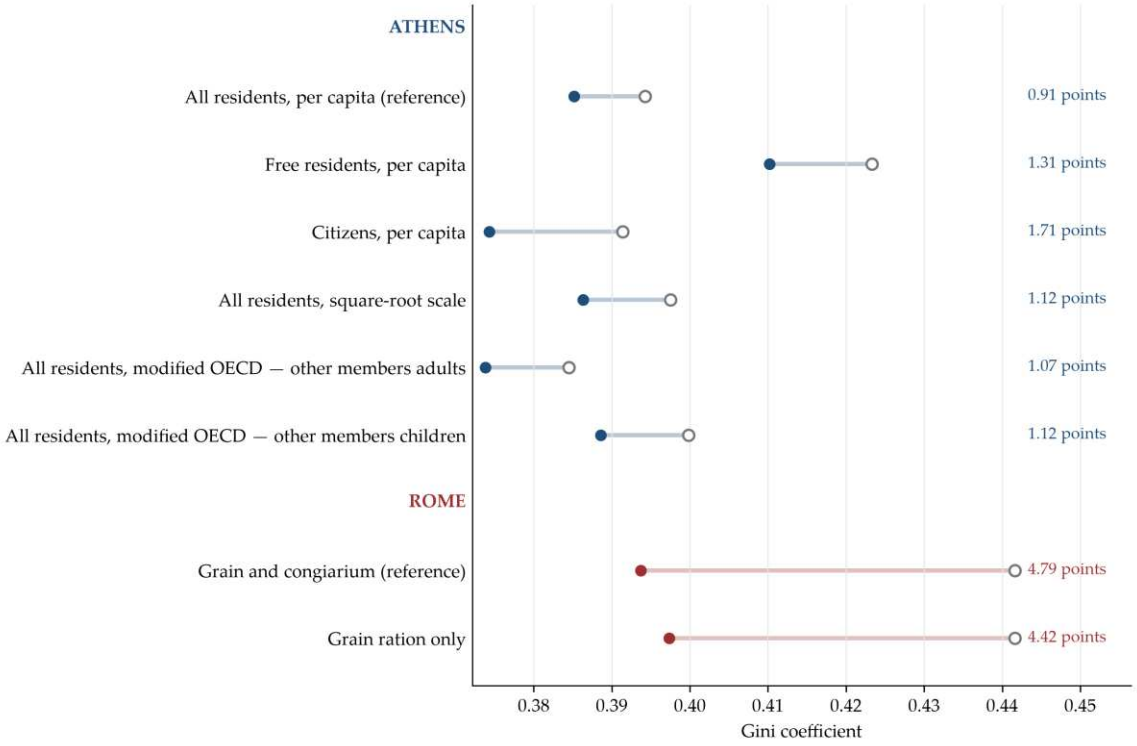


Figure 2

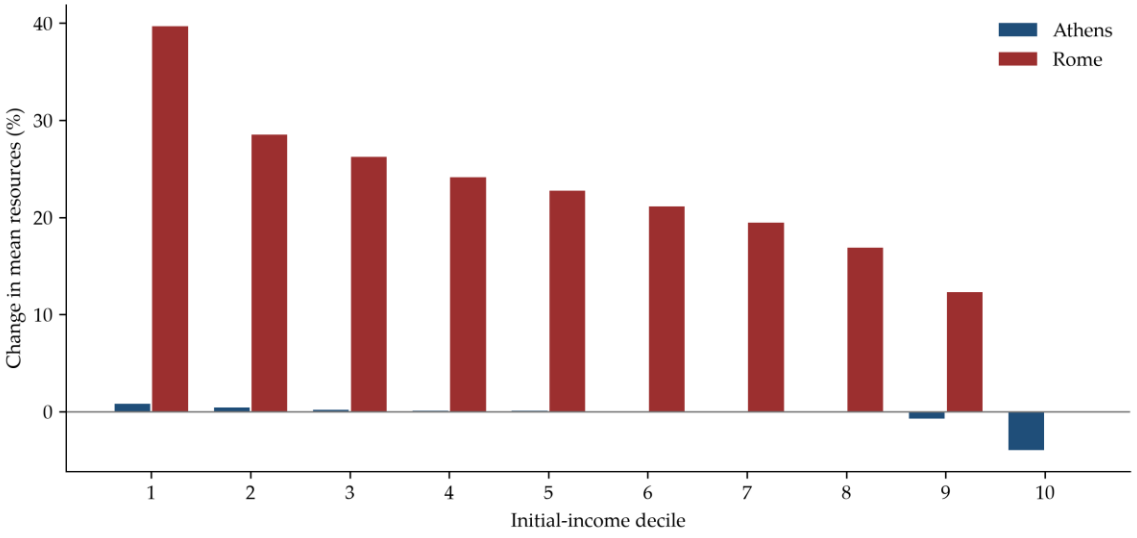
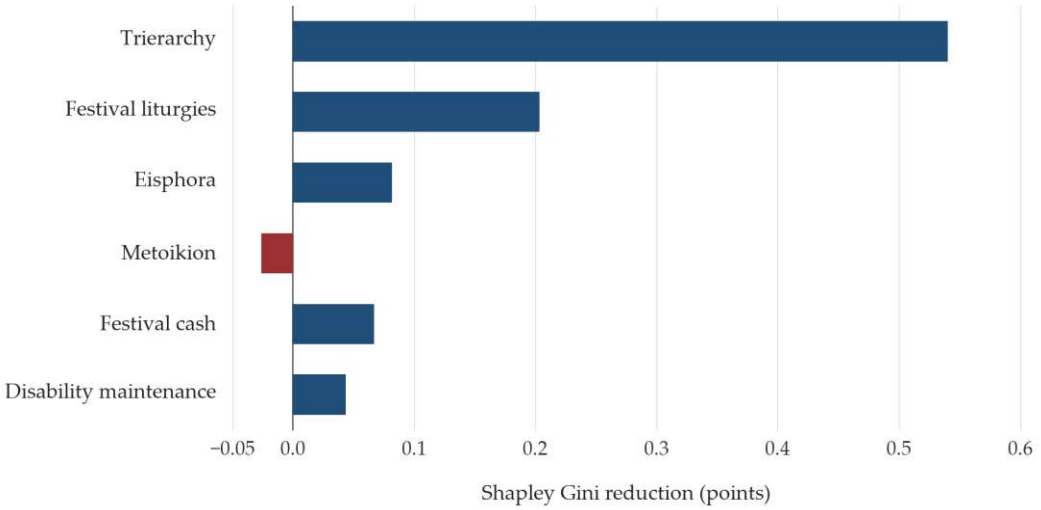


Figure 3



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465 **Figure 4**

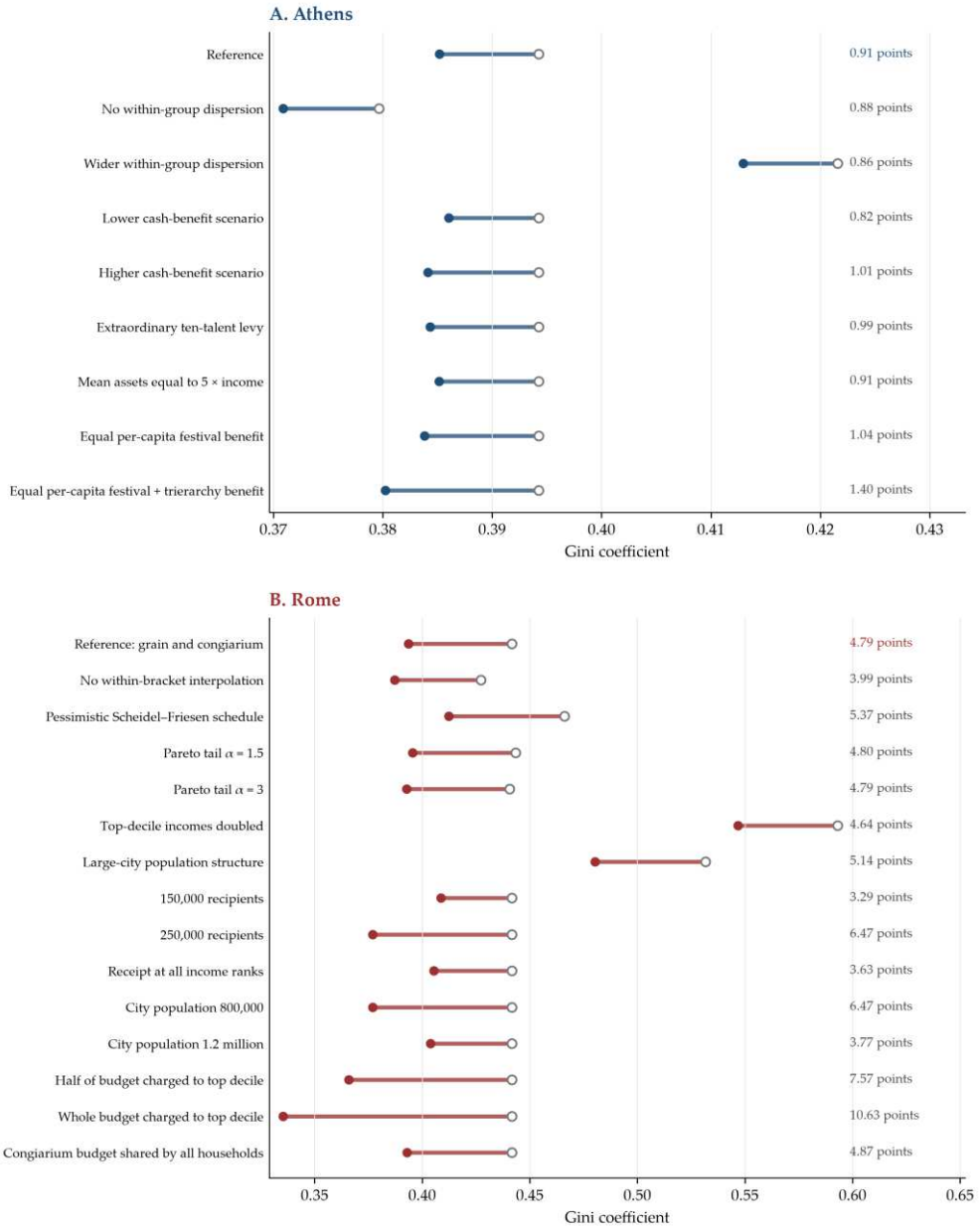
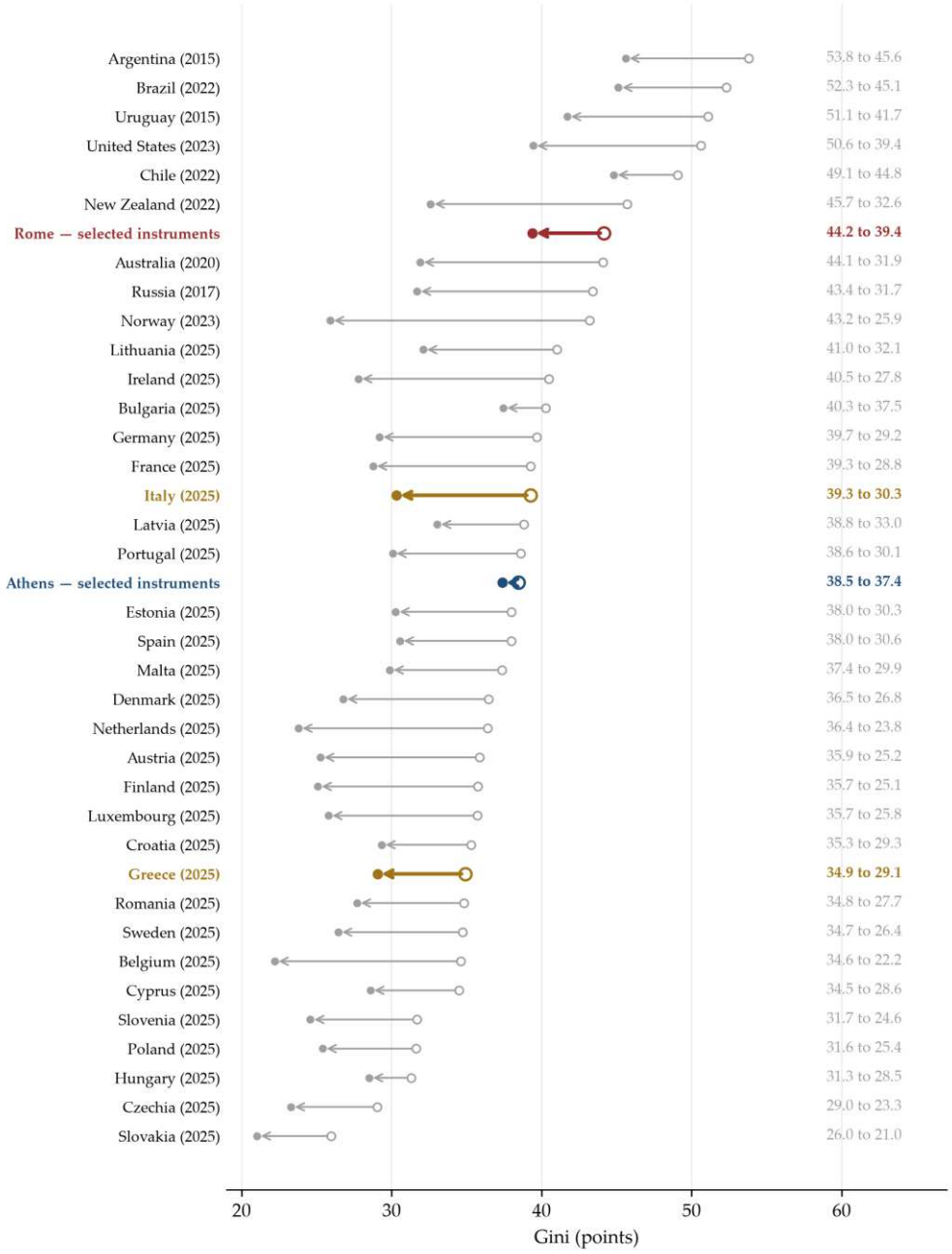

A. Athens
Reference
No within-group dispersion
Wider within-group dispersion
Lower cash-benefit scenario
Higher cash-benefit scenario
Extraordinary ten-talent levy
Mean assets equal to 5 × income
Equal per-capita festival benefit
Equal per-capita festival + trierarchy benefit
0.91 points
0.88 points
0.86 points
0.82 points
1.01 points
0.99 points
0.91 points
1.04 points
1.40 points
0.37
0.38
0.39
0.40
0.41
0.42
0.43
Gini coefficient
B. Rome
Reference: grain and congiarium
No within-bracket interpolation
Pessimistic Scheidel–Friesen schedule
Pareto tail α = 1.5
Pareto tail α = 3
Top-decile incomes doubled
Large-city population structure
150,000 recipients
250,000 recipients
Receipt at all income ranks
City population 800,000
City population 1.2 million
Half of budget charged to top decile
Whole budget charged to top decile
Congiarium budget shared by all households
4.79 points
3.99 points
5.37 points
4.80 points
4.79 points
4.64 points
5.14 points
3.29 points
6.47 points
3.63 points
6.47 points
3.77 points
7.57 points
10.63 points
4.87 points
0.35
0.40
0.45
0.50
0.55
0.60
0.65
Gini coefficient

Figure 5


Argentina (2015) 53.8 to 45.6
Brazil (2022) 52.3 to 45.1
Uruguay (2015) 51.1 to 41.7
United States (2023) 50.6 to 39.4
Chile (2022) 49.1 to 44.8
New Zealand (2022) 45.7 to 32.6
Rome — selected instruments 44.2 to 39.4
Australia (2020) 44.1 to 31.9
Russia (2017) 43.4 to 31.7
Norway (2023) 43.2 to 25.9
Lithuania (2025) 41.0 to 32.1
Ireland (2025) 40.5 to 27.8
Bulgaria (2025) 40.3 to 37.5
Germany (2025) 39.7 to 29.2
France (2025) 39.3 to 28.8
Italy (2025) 39.3 to 30.3
Latvia (2025) 38.8 to 33.0
Portugal (2025) 38.6 to 30.1
Athens — selected instruments 38.5 to 37.4
Estonia (2025) 38.0 to 30.3
Spain (2025) 38.0 to 30.6
Malta (2025) 37.4 to 29.9
Denmark (2025) 36.5 to 26.8
Netherlands (2025) 36.4 to 23.8
Austria (2025) 35.9 to 25.2
Finland (2025) 35.7 to 25.1
Luxembourg (2025) 35.7 to 25.8
Croatia (2025) 35.3 to 29.3
Greece (2025) 34.9 to 29.1
Romania (2025) 34.8 to 27.7
Sweden (2025) 34.7 to 26.4
Belgium (2025) 34.6 to 22.2
Cyprus (2025) 34.5 to 28.6
Slovenia (2025) 31.7 to 24.6
Poland (2025) 31.6 to 25.4
Hungary (2025) 31.3 to 28.5
Czechia (2025) 29.0 to 23.3
Slovakia (2025) 26.0 to 21.0
20
30
40
50
60
Gini (points)

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Supplementary Files

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