

ORIGINAL ARTICLE OPEN ACCESS

Assessing Ancient Inequalities: Hellenistic Delos

Filippo Battistoni | Marco Martinez 

University of Pisa, Pisa, Italy

Correspondence: Marco Martinez (marco.martinez@unipi.it)

Received: 30 September 2024 | Revised: 22 January 2025 | Accepted: 27 January 2025

Keywords: ancient inequality | classical Greece | epigraphic data | institutional change

ABSTRACT

This paper presents a new data set that measures inequality levels in the city-state of Delos at two different points in time during the period of its independence (314–167 BCE). We propose a new approach for quantifying ancient inequality and its evolution by relying on inscriptions that indicate property data and artisanal remunerations. A probabilistic approach is adopted to assess the uncertainty of the estimates and their sensitivity to assumptions. This paper finds that there was a decrease in wealth inequality of about 20% between the early and late periods of independence. We hypothesize that the main reason for the socio-economic changes is to be found in the new political status of autonomy that occurred in 314 BCE and resulted in a greater share of wealth being held by the middle class.

JEL Classification: D63, F54, N33

1 | Introduction

The study of inequality in the preindustrial world represents a well-known challenge, primarily due to the nature of the available sources and their limits. Several significant attempts have been made to address this problem. On the one hand, we have archaeoanthropological studies that are of great interest, as they are based on material culture and cover a very broad period (Bogaard et al. 2024; Lalueza-Fox 2022; Kohler and Smith 2018). Conversely, when approaching the classical world, particularly the Greek world, in addition to archaeological sources, we have access to literary and, even more importantly, documentary sources. However, the paucity of available sources makes it difficult to appreciate the evolution of inequality. Plagues, wars, and famines have been mentioned as possible factors capable of shaping inequalities in the classical world. In other settings, including prehistorical and modern preindustrial societies, context-specific institutional factors have been recognized to play a role.¹

This paper connects the changes in the economy that occurred during the period of political independence of Delos from Athens

to the overall inequality patterns among the inhabitants of the island. To do so, we draw upon a variety of epigraphic documents, including city archives. For the classical world, there are no comparable cases to that of Delos in terms of the variety and quantity of this type of data. When considering transactions involving land (rents or sales), which constituted a major source of wealth in the Greek world, evidence can be found in the records of poleis such as Athens, Tenos in the Aegean (Cyclades), Olynthus in Chalkidiki, and Mylasa in Asia Minor. However, these are episodic and quantitatively smaller corpora than that of Delos. Even in the case of Delos, the relative abundance of evidence must always be interpreted in light of its fragmentary nature, as is common when dealing with sources from the ancient world.²

For over a century, scholars have acknowledged the exceptionality of the socio-economic and financial information available about Delos. These sources provide insights into land transactions, the composition and compensation of the artisanal workforce, and the social status of notable individuals as inferred from prosopographical observations (see below). While the single aspects have been thoroughly investigated, as proved by a

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2025 The Author(s). *Review of Income and Wealth* published by John Wiley & Sons Ltd on behalf of International Association for Research in Income and Wealth.

substantial body of literature (Glötz 1913; Heichelheim 1930; Vial 1984; Osborne 1988; Reger 1994; Feyel 2006), they have not been combined to provide a systematic assessment based on documentary evidence about the distribution of wealth among the inhabitants of Delos, with the exception of Kron (2014) relying on a different set of data, namely house sizes.

This study focuses on the early (ca. 280 BCE) and late (ca. 190 BCE) phases of Delos' independence and suggests possible connections between trade openness, political independence, and patterns of inequality. While the earlier period reflects the levels of inequality of a city-state that had been directly managed by Athens until a few years before, the later independence period reflects the levels of inequality in a wealthy, commercially oriented city-state. Once liberated from Athenian domination, the Delians prospered and, far from remaining idle and enjoying their traditional temple-related privileges, invested in economic activities (see Section 2 for references).

Our work contributes to two strands of literature and methodologically builds upon a third recent one. First, we relate to the literature estimating inequalities in the classical world, by adding a significant case-study to a quite uncertain picture. Indeed, research on inequalities in classical Greece has thus far mostly concentrated on IV century BCE Athens. The extent of its inequality in this period is still subject to considerable debate, and the uncertainty of these estimates reflects a general disagreement about the levels of inequality in ancient Greek states.³ We contribute to this debate by providing a benchmark outside Athens and by examining its evolution over a period of approximately a century. In addition to Athens, other studies of inequality in the ancient Mediterranean have focused on the Roman Empire (e.g., Milanovic, Lindert, and Williamson 2007; Scheidel and Friesen 2009, and Flohr 2017). To ensure that the results are comparable over a broader time and spatial horizon than classical antiquity alone, we rely on the Gini index approach of Bogaard, Bowles, and Fochesato, Bogaard, and Bowles (2019) and Bowles and Carlin (2020).

Second, our study contributes to the literature that seeks to understand the drivers of preindustrial inequality patterns. Among this literature, Scheidel (2017, 43, 71–75, 265) has argued that violent events such as wars and plagues and the subsequent rise and fall of states can explain the decline in preindustrial levels of inequality. Alfani and Di Tullio (2019) have proposed that the combination of regressive taxation with the growth of military expenditure can account for the rise in inequalities in the early modern Republic of Venice. Van Zanden (1995) has associated increases in inequality during the early modern period. Alfani (2022), among others, has recognized the important role of epidemics. Piketty (2014) as well as Borgerhoff Mulder et al. (2010) who focused on the very long run, emphasized the prominent role of inheritance systems. In this study, we follow the current view about the association between political independence and commercial growth of Delos, as suggested by Reger (1994), and we bring inequality in the equation. Our approach complements most current studies which investigate either a broader geographical setting (e.g., the Roman empire) and/or aggregate data spanning over a longer period (e.g., house sizes), by offering a dynamic

assessment of inequality based on an in-depth case study. Investigating Delos has the advantage of being relatively well documented, but it is also a weakness because it is not easily generalizable to the entire Greek world. Finally, our research touches upon the probabilistic models recently proposed by Jew and Lavan (2023) for the ancient world, which are tested through simulation approaches (for Rome, see also Lavan 2019 and Brughmans and Wilson 2022).

The level of Gini wealth inequality observed during the early independence period (280s BCE) was 0.51, which is lower than the wealth inequality estimates for IV century BCE Athens. This level of inequality had decreased by about 20% in the 190s BCE. We tentatively suggest that the decline in inequality was driven by the island's openness to trade following its independence. This resulted in a concentration of wealth in the hands of a new group of merchants to the detriment of the elite. This mechanism prevailed over the increase in the number of landless/poor citizens, which would have an opposite effect on the Gini coefficient.

2 | Historical Background

Delos enjoyed a special position among the Greek city-states. In addition to its central position in the Aegean, the island was home to the very renowned temple of Apollo, who, according to the myth, was born on Delos. In the first half of the fifth century (477–454 BCE), the island hosted the treasury of the recently established Delian League. Athens exercised formal control over Delos, sending its own magistrates with the main task of administering the great wealth of Apollo even after the dissolution of the league. It was only in 314 BCE that Delos became free and autonomous thanks to Antigonos the One-eyed. Its independence lasted until 167 when Rome, by then the dominant power in the Mediterranean, attributed Delos to Athens and designated it as a free port.⁴

The aforementioned turning points—314 and 167 BCE—represent institutional epoch-making moments. The first one (314) resulted in the return of the island to the Delians that were finally able to administer it autonomously. During the period of independence, Delos became the administrative center of the Nesiotic League, a political association of Aegean island-states that was promoted and supported by Hellenistic kings, initially Antigonos I and subsequently Ptolemy I. While the relevance of this league is tiny in comparison to the Delian League, it contributed to elevating the status of Delos, which was already safeguarded by *asylia* (inviolability), within the international community. An excellent monograph by Gary Reger demonstrated that Delians were not merely idle exploiters of the revenues generated by Apollo's temple, but rather active participants in a regional network of commerce and economic exchanges. As Reger argues, this process of becoming involved in a regional network was gradual and spanning over generations. The network was central to the Delian economy and was influenced by local and regional phenomena to a greater extent than by the wider-ranging political events of the turbulent III century BCE. The second break (167) was harsher and more disruptive. As a consequence of the loss of autonomy, there was an immediate change in the economic activities of the island. The majority of Delians (in theory, all of them) were expelled

from their homeland and those who remained had the status of aliens, since Delos had become an Athenian overseas territory.⁵

Several convincing attempts have been made to write an economic history of Delos and they focus on the independence period, which is characterized by a rich body of documentation (see *infra*) and clear-cut boundaries. From an economic perspective, two notable trends emerge: (a) the rents of estates became gradually lower; (b) the rents of buildings (shops, warehouses, etc.) grew higher. Scholars have suggested that, when considered together, these two trends point to a major role played by commerce and a diversification of Delian economic activities during the period of independence.⁶ The fact that the rents of buildings grew higher may also indicate that the population involved in commercial activities faced higher production costs, which would contrast our finding of an increasing share of wealth owned by the intermediate classes. We observe that, from the period 282–250 BCE to the period 190–170, the median remuneration of artisans quadrupled. Taking also this into consideration, the higher rents can be seen as an indication of increased commercialization, which more than counteracted the production costs.

3 | Sources and Data Set

Notwithstanding the limits of the documentation about the ancient world, what makes Delos so special for modern scholars is the unparalleled abundance of detailed documents recording economic activities. The Delians, once they gained their freedom, implemented the Athenian recording system and carved on stone copies of the administrative documents relating to the finances of the temple. These accounts provide information on all expenditures, including salaries paid to the workforce, purchases of goods such as oil and animals, and other costs; they also include income figures, such as rents from estates and buildings, interest on loans, and donations.

However, this wealth of data is partial and incomplete, due to both the loss of material and issues intrinsic to the documents. Records change over time and gradually become more detailed. For several years, the stones are lost, resulting in a gap in the data, for example, regarding rents between 268 and 250 and 246 and 219. Finally, the preservation of the records varies, with some being more well-preserved than others. To sum up, our evidence is scattered, albeit very rich. Possibly the most relevant feature for our analysis is the fact that the accounts refer only to the temple finances, with the exception of the very last decades (beginning of the II century BCE), during which the civic accounts were also carved on stone.

The temple was a major economic actor. When the limited size and resources of the island are considered, the ratio of sacred to civic economy differs from that observed in most poleis, and is comparable only to Delphi. The sanctuary constituted a reserve of capital, a large landowner (which is the reason why we are aware of the extent of rents), and a major employer. We can postulate an evolution of the relationship between civic and sacred economy. During the Classical period, the temple was directly managed by Athens and its economic agency prevailed over the civic ones. During the period of independence, on the other hand, the

civic and sacred economies, while remaining formally and substantially separate, showed a greater degree of integration, since the Delians themselves managed the finances of the temple. It is therefore reasonable to assume that in this period the relationship was much less unbalanced. In this sense, the fact that civic accounts began to be recorded in stone at the beginning of the II century BCE could be interpreted as a sign of the growing importance of the civic economy. A real break in the economic relationship between city and temple occurred when Delos became a free port, at which point the civic economy was by far predominant (most recently, Zarmakoupi 2022 from an urbanistic perspective).

Looking only at the sanctuary inevitably provides us a partial view of Delian society. Nevertheless, the cross-section it offers is broad. In order to supplement the partiality of the temple accounts, we rely on information from other sources, such as decrees and honorary inscriptions, through which we can gain insights into the social standing of the individuals mentioned in them, who usually are members of the upper strata. By employing such documents and the prosopographical study offered by Claude Vial, we attribute each individual to the most plausible group (see next section). Figure 1 shows the total number of attested individuals for each period.⁷

All information used in this paper comes from inscriptions. The majority of the data has already been collected in special studies, such as a comprehensive register of citizens and a comprehensive register of aliens (see Table 1, Panel A). The aforementioned lists include information about economic and political activity, and we refer to them for practicality. Furthermore, we rely on other studies that group individuals according to financial and/or prosopographical information, such as family trees, artisans (including works executed and wages), and land tenants (including estate rents) (see Table 1, Panel B).⁸

4 | Empirical Approach

We rely on the Gini coefficient to measure wealth inequality. The Gini coefficient is a measure that ranges from 0 (complete equality) to 1 (all wealth is held by one person). The data requirements for computing a Gini index are relatively few, so Gini indexes are available in many societies and periods. We adopt the method recently developed by Fochesato, Bogaard, and Bowles (2019). Their approach has the advantage of making comparable the set of preindustrial Gini inequality estimates measured to date, even though they are based on different sources and rely on different data collection and sampling methods. The Gini index is calculated as follows:

$$G = n + u - (1 - u) s$$

This specification of the Gini index is particularly suitable to our scenario as it takes into account the fact that besides the two classes of large and small wealth holders, most societies, including Delos, have had a fair share of those without wealth. In the formula, s indicates the share of wealth owned by small-scale wealth holders, also referred to as “Group 2”; n indicates the number of individuals belonging to Group 2 over the total population, which also includes those without wealth; u indicates the share of the population which belongs to the group of those without wealth, also referred to as “Group 3”. For example, if n

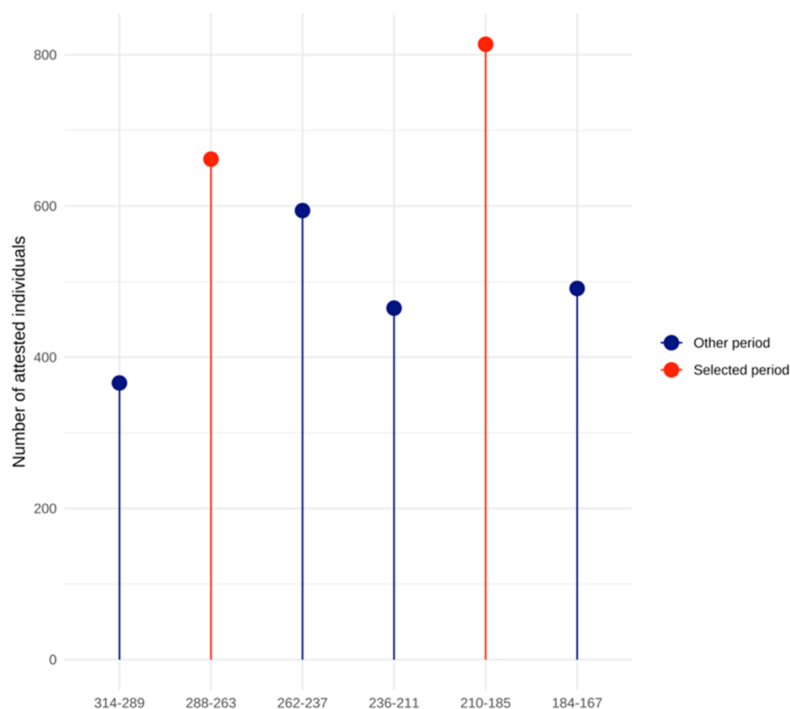


FIGURE 1 | Number of recorded individuals by period. *Source:* Own elaborations of inscriptions (see Table 1).

TABLE 1 | Summary of the analytical studies employed in this research.

Type	Study	Example
Panel (A). Registers of inhabitants in Delos		
Register of citizens	Vial (2008)	Dexikles son of Timothemis, collector of the tax of Rhenea
Register of aliens	Tréheux (1992)	Sotadas of Crete, metic choregos at the Dionysia, renter of sacred land
Panel (B). Thematical collection of financial and prosopographical data		
Rents of sacred land	Pernin (2014, 236–237)	Aristodikos, tenant and <i>choregos</i> , rent of 1100 <i>drachmai</i> in 282 BCE
Family trees	Vial (1984, 218)	Aristodikos son of Antikrates, part of a politically involved family
List of artisans (with commissions)	Feyel (2006)	Deinomenes son of Leophantos, carpenter, and engraver, received 70 <i>drachmai</i> for engraving a stele in 300 BCE (IG XI, 2147)

is equal to 30% and s is equal to 20%, it can be inferred that 80% of the population owns a total of 30% of the total land wealth. If the population of individuals in Group 3 is 40%, the resulting Gini index is $G = 0.3 + 0.4 - (0.6) \times 0.2 = 0.58$. It can be useful to remark that an increase in the proportion of individuals in Group 3 from Periods 1 to 2 may nonetheless result in a lower Gini index if, as in our case, the share of wealth held by Group 2 is sufficiently greater than the one observed in Period 1.

Quantifying the entire population of a town or village is usually unattainable in the classical world, and this often prevents the calculation of the Gini index we just described. In the case of Delos, however, we are fortunate to have at least indirect evidence of the entire population of adult male citizens in 173 BCE, which provides a valuable basis for making a well-informed hypothesis about the population in earlier periods. The number of Delian citizens in 173 BCE was calculated by Philippe Bruneau, with a subsequent slight correction by Claude Vial. In that year, records about the festival of Poseidon document that the officials in

charge reported the total cost of the gift meals, which amounted to 250 *drachmai*. Gift meals were offered to all adult male citizens who attended the festival. In the same year, 50 *drachmai* were spent on the nonattending citizens. Since the equivalent indemnity for the nonattending citizens was 1.5 *obol* (0.25 *drachmai*), it is possible to calculate the number of attending citizens by dividing 250 by 0.25, which equals 1000. The same methodology was applied to account for the nonattending citizens (50/0.25), resulting in an estimated total population of adult males in 173 BCE of approximately 1200. To calculate the population of citizens in earlier periods, we employ a yearly growth rate of 0.35%, which is an intermediate value between a maximum of 0.5% and a minimum of 0.25% estimated for the Greek world. The results are generally robust to the use of both the lower (0.25%) and the higher (0.50%) population growth rates (see Table 3, Panel C).⁹

We consider that the number of male citizens is representative of the number of households, which also included women and

slaves. In fact, women who owned assets constituted a minority and needed a tutor. Furthermore, slaves could run businesses, but they were not legally independent. The quantification of the slave population is an exceptionally challenging endeavor. We cautiously propose three alternative scenarios that include the slave population, based on data calculated by Walter Scheidel for the urban population of Roman Italy and for the city of Alexandria. The minimum of 10% is based on the low estimate of slaves in the urban population from Roman Italy, while the maximum of 20% is based on the high estimate of slaves from Alexandria. The intermediate value is the mean of the two values (15%).¹⁰

The fragmentary status of the evidence does not allow a year-by-year study. To compensate for the lack of continuous data, the period has been divided into six subperiods, each corresponding to a generation of 25 years (the last one is 8 years shorter because the independence ends in 167). Subperiods 1, 2, 3, 4, 5, and 6 span the following timeframes: (1) 314–289; (2) 288–263; (3) 262–237; (4) 236–211; (5) 210–185; and (6) 184–167. As our study is based on individuals (all Delians, of whom we have knowledge), we consider such a unit of time to be an appropriate measure of generational change.

To categorize the Delians according to their economic status, we rely on the information concerning their political and economic activity. The term “activity” is used in a deliberately generic sense to indicate the reason why an individual appears in documents. Economic activities include renters, landowners, entrepreneurs, artisans, as well as guarantors. In the political sphere, holding a certain office (in Delos) was directly related to the economic capacity of the person. Political activities include charges such as bouleutai (members of the council), hieropoi (administrators of the temple), archons (chief civic magistrates), treasurers, or commissioners. Individuals mentioned only for extremely trivial and occasional services are excluded. Consequently, the number of individuals lacking land ownership is determined by subtracting the estimated total population from the population of individuals appearing on the lists. Individuals are classified as Group 1 when their activity is indicative of possession of significant economic resources. In the political sphere, this encompassed the hieropoi and the prodaneistai, who were responsible for guaranteeing loans contracted by the city. In the realm of economic activities, this encompassed landowners and their guarantors. Individuals such as guardians, artisans, and tenants are classified as minor landowners (Group 2), since their economic activities do not necessitate the use of considerable economic resources. It is not uncommon for an individual to be documented as engaging in multiple activities. In such instances, the individual is classified according to the activity that denotes the higher status. For example, Epiktemon son of Meilikos rented warehouses around 200, and this would put him in Group 2, but he is attributed to Group 1, since he had been archon.

Table 2 provides examples of the political and economic activities of individuals that fall within each group. As we proceed by hypothesis accumulation, prosopographical cross-examination confirms the soundness of the reconstruction. For instance, hieropoi are conspicuously present as renters of sacred land. In cases where the status is more difficult to determine, such as that of choregoi (sponsors of dramatic performances) or owners of small properties, three main scenarios are proposed. The first

TABLE 2 | Examples of the classification into socio-economic status groups.

Group	Examples
1	<u>Hieropoi</u> , <u>prodaneistai</u> , <u>archons</u> , bankers, guarantors
2	<u>Logistai</u> , <u>sitones</u> , artisans, heralds, guardians, architects, tenants
3	Wealth-less individuals (slaves)

Note: In Groups 1 and 2, the examples cover both political and economic indexes to status. The political and institutional charges are underlined. In Group 3, slaves are put in parentheses because they are included only in some specifications.

(scenario “A”) codes them as part of Group 1, thus representing an upper bound of the number of individuals belonging to Group 1. The second scenario (scenario “B”) assigns them to Group 2, thus representing a lower bound. The third (scenario “C”) assigns them according to the class that, based on the available prosopographical information, is more likely. For example, approximately half of the choregoi for whom we have more data on their activity, around half were also hieropoi, while the other half were simply renters of commercial businesses. Consequently, the remaining choregoi are divided into two groups: Group 1 and Group 2. The next section will discuss the sensitivity of the results to each scenario.

Ascertaining the proportion of wealth owned by the groups of wealth holders (1 and 2) is not an easy task. Despite the relative abundance of economic data in independent Delos, we are lacking data on the wealth of business owners and of tax collectors. We have identified two types of financial information, one for each group of wealth holders, for which we have more detailed data. As the temple of Apollo was an important landlord and its transactions were carefully recorded, we are able to gain a fairly comprehensive picture of the rent values of sacred estates and their evolution. An analogous consideration can be applied to the remuneration of artisans for temple-related works. We rely on these sources to obtain indicative information regarding the distribution of wealth in Delos. It is important to note that this measure is limited in that it does not account for all forms of wealth or income: not all wealth is derived from land, and not all income is derived from remuneration for temple work.¹¹

We relied on two complete sets of leases: one from the first period (year 269) and one from the second period (192). Subsequently, an examination was conducted to ascertain the number of lessees who could be classified as belonging to Group 1 and Group 2, respectively, based on prosopographical evidence suggestive of an upper-class status, such as the holding of costly political charges. The mean land value for Group 1 citizens was then calculated. The mean value of the remaining lands is employed as an initial estimate of the proportion of wealth owned by Group 2 (see Table A1). The second measure of the share of wealth owned by the intermediate class is the mean compensation received by artisans in each period.

To verify and possibly corroborate our key hypothesis regarding the proportion of wealth held by the different groups, we rely on the size data of the 91 houses cataloged by Trümper (1998)

and consider them as referring to the period of late independence (210–185), since it is closer to the proposed chronology of the archaeological contexts (late third to early first century BCE). Since Group 1 constitutes 30.7% of the population, it corresponds to the first 27 houses in order of size, which represent 55.5% of the total house surface. This figure corroborates the estimate of the proportion of wealth held by Group 1, according to the method we used, which for the period 210–185 gives a result of 52.7% (most likely value: see Table A1).

The division of the individuals into three groups might appear to follow a social table approach, in which each group is assigned an average amount of wealth or income (e.g., Modalsli 2015; Scheidel and Friesen 2009; Milanovic 2006). Our case has some similarities with the social table approach, but also important differences. Looking at the population, one could attempt a detailed disaggregation based on a finer-grained distinction between political charges. However, in the case of Delos, it may very well result in an arbitrary process, since there were no fixed census requirements to hold political charges. If one nevertheless wished to operate in this way, one would be faced with a lack of data on the wealth to be attributed to each class. Taking these difficulties into account, we created groups, not social classes, that associate wealth derived from certain types of activities (in particular, agricultural) with socio-political prominence, while a lesser political commitment is linked with mainly artisanal activities. This takes for granted the fact that, within the Greek city, holding certain political offices was a social duty of the better-off. Given the available sources, the only way to reach a comparable parameter would mean using evidence based on house sizes. Such evidence however is limited only to the second period and not available for the first one, making comparison de facto impossible.¹²

In most ancient poleis, in addition to citizens and slaves, there were also resident aliens (metics). The status of metic was legally defined, but precise data on most individual metics in Delos are lacking. Jacques Tréheux assembled a comprehensive register of aliens drawn from all Delian inscriptions. Such inscriptions can be quite precisely dated, according to internal or external indices, and often specify the main activity of the alien. It is not always possible to ascertain with certainty whether these individuals were recognized as metics. We identify individuals as metics if they comply with either one of two criteria: (a) a person is explicitly mentioned in the inscription as metic; (b) a person is an alien whose occupation or activity suggests a prolonged stay in Delos, such as renter, guarantor, and craftsman—either unskilled or contracted for long-lasting public works.

To assign metics to Group 1 or 2, we follow the same approach as for citizens. Figure 2 shows the proportion of metics over the number of citizens in the period between 288 and 167 BCE. The proportion of metics does not follow a linear trend: it is as high as 12% in the period 288–263 (Period II) and gradually declines to about 6% in the period 210–185 (Period V). This result could be a pure coincidence due to the limitations of the sources, or it could be due to our mistake in identifying the metics. Otherwise, we can assume that the openness of the island after independence, as well as its being the center of the Nesiotic League, contributed to making it more attractive. The gradual stabilization of the proportion of metics can be explained, at least in part, by the fact that some metics were naturalized among the citizen population.¹³

The robustness of our results to individual assumptions is supported using Monte Carlo simulation scenarios, following the approach proposed by Jew and Lavan (2023). Monte Carlo-simulated scenarios include permutations of specific

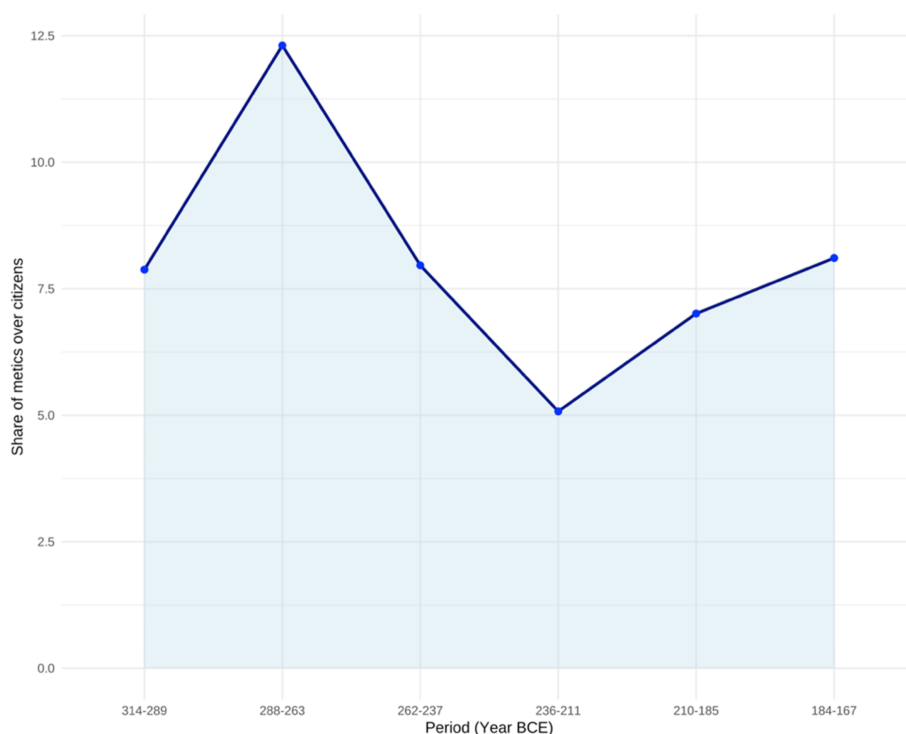


FIGURE 2 | Share of metics over citizens according to attested individuals. Source: Own elaborations from Vial (2008) and Tréheux (1992).

TABLE 3 | Wealth Gini estimates in Delos, 288–263 BCE and 210–185 BCE.

Panel (A). Most likely estimates		
Period	Slaves	
	(1) No slaves	(2) 15% of population
I (288–263 BCE)	0.489	0.561
II (210–185 BCE)	0.374	0.457
Percentage change	–23.5%	–18.5%

Panel (B). Monte-Carlo simulated estimates		
Period	Estimate (no slaves)	
	(1) Mean	(2) HDI
I (288–263 BCE)	0.51	[0.38–0.59]
II (210–185 BCE)	0.41	[0.31–0.51]
Percentage change	–19.6%	[–15.5% to 21.5%]

Note: The Monte-Carlo simulations randomly draw 10,000 times the parameters needed to calculate the Gini index (n , u , and s) from a triangle distribution which includes the minimum, maximum, and most likely value of each parameter, and uses the 80% Highest Probability Density Interval (HDI). For Period I, the range of values of the share of Group 2 individuals is 0.28–0.51, the share of wealth is 0.20–0.39, and the share of Group 3 individuals is 0.29–0.30. For Period II, the range of values of the share of Group 2 individuals is 0.28–0.51, the share of wealth is 0.37–0.54, and the share of Group 3 individuals is 0.32–0.32.

instances randomly drawn across the range of plausible values, presented in the form of a probability distribution (each potential outcome is assigned a probability of occurrence, which is measured as the relative frequency with which it occurs in the simulation). This approach allows us to quantify the uncertainty of our estimates.

5 | Results

Based on the classification proposed in the previous section, the Gini coefficient is calculated for the two periods we consider. Before discussing the results, it may be helpful to provide an illustrative example of the methodological steps related to the extraction of the Gini coefficients. In the period of early independence, the most likely estimated population of citizens is 840 and of metics 72, 38 of which are found to belong to Group 2. The population share in Group 2 is thus $n = \frac{316+34}{912} = 0.39$. The population share in Group 3 is $u = \frac{278}{912} = 0.31$, while the share of wealth owned by Group 2 is $s = 0.29$ (see Table A1).¹⁴ The resulting Gini coefficient is thus $G = 0.39 + 0.31 - (1 - 0.31) \times 0.29 = 0.489$, as displayed in Table 3, Column 1. The same procedure is carried out to calculate the Gini coefficient for the late independence period. For both periods, are presented alternative scenarios in terms of wealth owned by Group 2, population growth rates and the share of slaves in the population, as shown in Table 4.

During the period of political independence, we observe a significant reduction in wealth inequality, which fell by a value of about 18%–23% from the earlier period (288–263) to the later period (210–185 BCE) (see Table 3, Column 1). This pronounced decline

in inequality is consistent across all sensitivity analyses of the Gini estimates (see Table 4). In particular, the levels of the Gini index are mostly unaffected by changes in the proportion of slaves in the population (Table 4, Panel A), by alternative scenarios of the proportion of wealth owned by Group 2 (Table 4, Panel B), and by population growth rates (Table 4, Panel C). The estimated inequality levels are approximately 0.10 points higher when the number of individuals in Group 1 is overestimated (Scenario “A”) and approximately 0.10 points lower when the number of individuals in Group 2 is overestimated (Scenario “B”). The Gini levels of such scenarios are not plausible since they represent extreme values of “interval estimates,” which refer to improbable population compositions (Jew and Lavan 2023, 7).

Monte-Carlo simulations are a more powerful tool to quantify the joint uncertainty that comes from the reliance on a set of uncertain coefficients. We run such simulations by relying on the minimum, maximum, and most likely values of the components, drawn at random from a triangle probability distribution. This has the great advantage of allowing to specify the most likely value of each parameter.

The resulting Gini index is an average of the Gini indexes obtained through 10,000 iterations of the simulation (see Figure 3). The point estimates and uncertainty are aligned with our pre-simulation estimates (compare Table 3, Panel A with Table 3, Panel B). The decline in the Gini index observed after independence can be attributed mainly to an increase in the proportion of wealth owned by Group 2 in Period II (see Table A1).

A comparison with other Gini estimates can both corroborate the plausibility of our figures and situate them within the broader framework of ancient Mediterranean economies. Figure 4 provides a summary of the Gini inequality values proposed by other scholars. Our study posits that the Gini value at Delos between 288 and 263 BCE was 0.51. The wealth inequality Gini for Athens is 0.71, which is higher than our estimate for Delos in the early independence (0.48). Kron (2014) suggested a Gini value of 0.35 for Delos based on house size. This estimate is in line with our result of 0.37 for the late independence period. Furthermore, if we assume a share of Group 3 individuals of 30% as in our study, following the approach of Fochesato, Bogaard, and Bowles (2019), the house size-based Gini appears to be slightly higher (0.51) and similar to the one estimated in larger urban centers such as Pergamum and Carthage in the Hellenistic period (Kron 2014).

When considering the Mediterranean during the Roman period, the inequality observed in late independence Delos (0.37) was comparable to that calculated for the Roman Empire in the second century CE, the Samnium (Southern Italy) in 101 CE, and Egypt in the third century CE. In contrast, inequality was higher in 79 CE Pompeii and Herculaneum.

Against these results, a possible explanation could come from observing the increased importance of commercial activities in the economy of Delos. Reger (1994) suggested that Delos saw a greater prosperity toward the end of the III-beginning of the II century BCE. He based his argument on an examination of economic factors such as the variation in the prices of rents and leases as well as of several goods (especially pigs, oil, and wood). Furthermore, Reger (1994, 257–264) suggested that Delos

TABLE 4 | Sensitivity analysis of wealth Gini estimates in Hellenistic Delos.

Panel (A). Sensitivity analysis: Impact of the range assumed for number of slaves on the Gini index (in %)					
Scenario	Period	% slaves			
		0%	9% of population	15% of population	50% of population
A	I (288–263 BCE)	0.62	0.65	0.67	0.74
	II (210–185 BCE)	0.50	0.55	0.57	0.67
B	I (288–263 BCE)	0.38	0.44	0.47	0.59
	II (210–185 BCE)	0.27	0.33	0.36	0.51
C (most likely)	I (288–263 BCE)	0.49	0.54	0.56	0.66
	II (210–185 BCE)	0.37	0.43	0.46	0.58

Panel (B). Sensitivity analysis: Impact of the range assumed for the wealth owned by the top two classes on the Gini index (in %)				
Scenario	Period	% of wealth owned by Group 2		
		Minimum	Intermediate	Maximum
A	I (288–263 BCE)	0.68	0.62	0.55
	II (210–185 BCE)	0.58	0.50	0.46
B	I (288–263 BCE)	0.45	0.38	0.32
	II (210–185 BCE)	0.34	0.27	0.23
C (most likely)	I (288–263 BCE)	0.56	0.49	0.42
	II (210–185 BCE)	0.45	0.37	0.33

Panel (C). Sensitivity analysis: Impact of the range assumed for the population growth rate the Gini index (in %)				
Scenario	Period	Annual population growth rate		
		0.25%	0.35%	0.50%
A	I (288–263 BCE)	0.67	0.62	0.58
	II (210–185 BCE)	0.52	0.50	0.49
B	I (288–263 BCE)	0.46	0.38	0.33
	II (210–185 BCE)	0.30	0.27	0.26
C (most likely)	I (288–263 BCE)	0.56	0.49	0.44
	II (210–185 BCE)	0.40	0.37	0.36

Note: Panel (A). The baseline model considers either no slaves in the population or adds 15% to the population as slaves. Scenario A corresponds to a society where if uncertain, an individual is coded as belonging to the elite (Group 1); Scenario B corresponds to a society where if uncertain, an individual is coded as belonging to Group 2; Scenario C corresponds to a society where if uncertain, an individual is coded as belonging to the most likely class, considering additional prosopographical information. Panel (B). The maximum share of wealth owned by small landowners is 38% in the first period and 54% in the second period. The minimum value of wealth owned by Group 2 is 20% in the first period and 37% in the second period. The intermediate and benchmark value is the average of the minimum and maximum values, corresponding to 29% in the first period and 48% in the second period. For scenarios: See note 2 of Panel (A). Panel (C). The baseline model relies on an annual population growth rate of 0.35%. For scenarios: See note 2 of Panel A.

became a local transshipment point for the Kykladic commercial traffic, which finds corroboration, among other things, in the establishment of a new commission to foresee the renovation of the harbor infrastructures.¹⁵ Our research adds a nuance to this narrative, showing that during the postulated economic transition in the second half of the III century BCE, there was a reduction in the levels of inequality.¹⁶

6 | Conclusion

The island of Delos was one of the most important religious centers of ancient Greece, eventually becoming a prominent trade hub thanks to its tax-free status (from 167 BCE onwards). Before that, starting from 314 BCE, Delos ceased to be under Athenian control and became independent. The transition in the economic sphere was gradual and complex. The present study offers

an assessment of ancient inequalities in Delos after the institutional change. Despite the limits of the available sources, our estimates allow us to assess inequality at two distinct points in time, one at the inception and one at the end of the period of independence.

The estimated levels of inequality are consistent with those of other ancient Mediterranean societies, but we also observe a notable decrease in wealth inequality of about 20% after about a century of independence from Athens. This decrease in inequality is largely explained by an increase in the share of wealth in the hands of small-scale wealthholders (Group 2). This suggests that inequalities in the classical world, as for later preindustrial societies, could be susceptible to institutional changes.

To appreciate the applicability of our research to other contexts, two issues need to be kept in mind. The first is that the temple

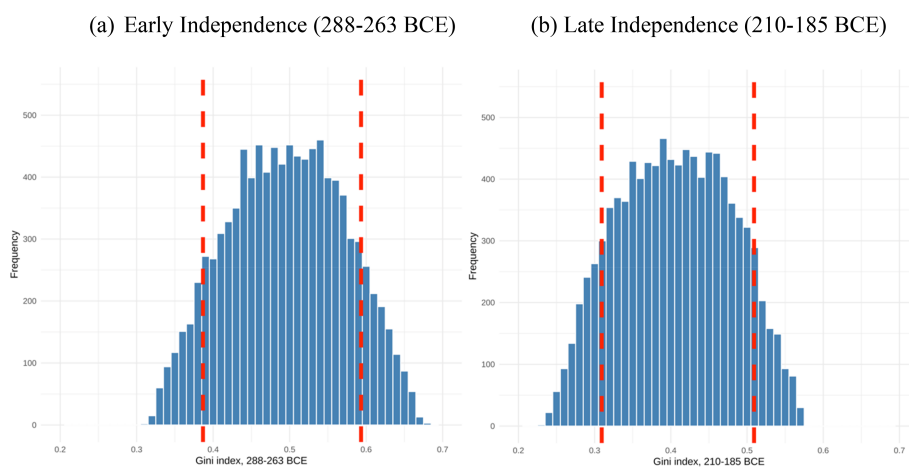


FIGURE 3 | Frequency distribution of the output (Gini indexes). (a) Early Independence (288–263 BCE), (b) Late Independence (210–185 BCE). The frequency of Gini indexes is based on the range of minimum, maximum, and most likely values of wealth and relative representation of Groups 2 and 3 individuals. The specific instances of each parameter are drawn 10,000 times from a triangle probability distribution. HDI intervals of 80% are shown as vertical dashed lines.

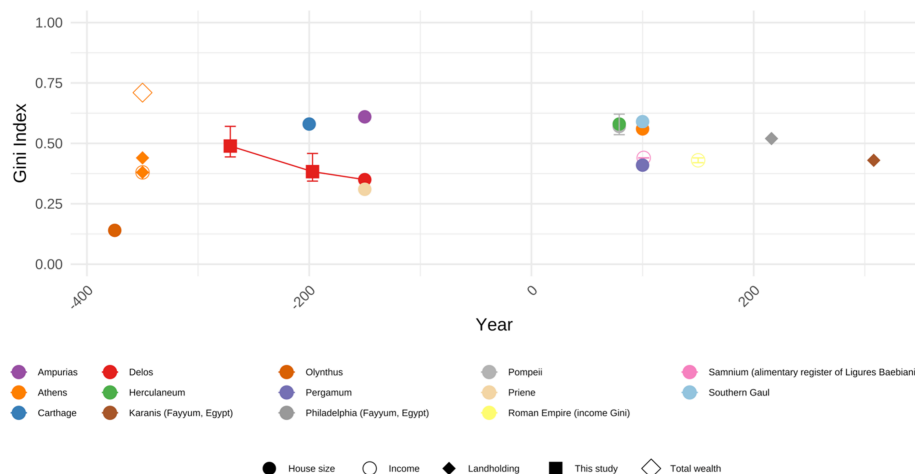


FIGURE 4 | Comparison of Gini estimates in the ancient Mediterranean. *Source:* Delos: This study and Kron (2014, 129). Athens: Morris (2000, 2009) and Ober and Scheidel (2022) for the minimum, Kron (2011) for the maximum, average for intermediate value. Pompeii-Herculaneum: Flohr (2017), for extreme values and Fochesato, Bogaard, and Bowles (2019) for intermediate values. Samnium: Duncan-Jones (1982, 346). Imperial Rome: Scheidel and Friesen (2009); Roman Egypt (Fayyum): Bagnall (1992). The Gini coefficients for Ampurias, Southern Gaul, Carthage, Pergamum, Priene, and Olynthus are derived from Kron (2014, 129). The interval estimates for Delos, Pompeii, and the Roman Empire are based on the minimum, maximum, and most likely estimates.

of Apollo attracted external capital and was a large landowner, so the ratio of the sacred economy to that of the city might be an anomalous case. The second is that the available financial information is mostly confined to transactions of the temple, thus providing only minimal information about the civic economy. Regarding the first point, we are unable to propose a solution and hope that further research focusing on other poleis can help. As for the second point, the situation is perhaps less problematic than it seems. While the picture we get from the purely financial and economic point of view is large, but limited to temple transactions, the information we obtain from the entire set of documentary sources about Delian society is abundant. When analyzed prosopographically, these documents can shed much more light on the socio-economic situation of the Delians than the sanctuary data suggest.

The results we offer should be understood as a starting point for further research that could corroborate or disprove our findings. It will be a remarkable achievement if additional research from other perspectives will allow to gain a stronger foothold on the relationship between institutional change and inequality in the ancient world.

Acknowledgments

We particularly thank Guido Alfani, Robert Allen, Jörg Baten, Michele Bolla, Domitilla Campanile, Sergio Cesaratto and Mattia Fochesato for their insightful comments. We also thank all participants of the World Economic History Conference (Paris 2022), ASE Conference (Turin 2024), and EHS Conference (Glasgow 2025). Open access publishing facilitated by Scuola Superiore Sant'Anna, as part of the Wiley - CRUI-CARE agreement.

Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data and codes that support the findings of this study can be accessed at the following link: <https://doi.org/10.3886/E216381V1>

Endnotes

¹ For an overview, see Scheidel (2017), Alfani (2021) and, for an example of a more context-specific analysis about the causes of inequality, Alfani and Di Tullio (2019). Although only for the industrial period, Milanovic (2016) recognizes the importance of less idiosyncratic factors, such as structural change and urbanization, in the inverted U relationship between inequality and modern economic growth proposed by Kuznets (1955). For a focus on how institutional mechanisms have shaped inequality over the long term, Chirikure et al. (2018), Alfani and Carballo (2023). For a review of surplus theory, according to which institutions regulate the extraction and distribution of social surplus and on which the work of Milanovic, Lindert, and Williamson (2007) is based, see Cesaratto (2024).

Interdisciplinarity may encounter some obstacles when it comes to specific choices. Our use of the term ‘institutions’ and its derivatives is a case in point. For scholars working on the Greek city-states, “institution” has a very specific meaning and, as a way of studying the past, a consolidated and well-defined tradition (suffice it to refer to the work of Gauthier 2011). Institutions refer to the official charges, civic bodies and the mechanisms by which the poleis were administered. However, given the scope and methods of our study, we follow the practice of economic history studies. In this context, the term is used loosely to indicate a form of government or the political situation of a particular state, community, and so on (see, e.g., the seminal work of North 1990). The volume by Murray and Bernard (2024) proposes ways to move beyond the new institutional paradigm in ancient economic history.

² A very useful and comprehensive collection of land transactions in the Greek world is the monograph by Pernin (2014).

³ For a lower bound of inequality in Athens, see Morris (2000, 140–142), followed by Morris (2009, 120), Bresson (2015, 145), Ober and Scheidel (2022); for the upper bound, see Kron (2011, 129–138 and 133–135), Ober (2015, 493) and Gallego (2017, 79–80). For egalitarian interpretations of the ancient Greek society, see Burford Cooper (1977–1978), Hanson (1995). For inegalitarian interpretations, see Foxhall (1992, 157), Foxhall (2007), and Van Wees (2011), supported by Kron (2011) for Athens. Other attempts of assessing the distribution of wealth in IV century BCE Athens include Ruschenbusch (1985).

⁴ See Will (2003). On Delos and the Cyclades, Reger (1994, 17–47). More recent, focusing on Delos in the III century BCE: Constantakopoulou (2017).

⁵ For the history of the Cyclades in II century BCE and an economic interpretation, see Reger (1994, 17–47).

⁶ See Osborne (1988, 279–324); from an economic point of view, Reger (1994, 249–76), divides the independence period into three sub-periods: 314–290 (uncertainty and adjustment); ca. 290–230 (steady economy); 230–167 (new prosperity). It must be mentioned, as economically relevant, that in the first quarter of the III century Delos obtained the repayment of substantial international loans that had been outstanding since the Athenian domination period (see Migeotte 2014, 622–623).

⁷ On the economic history of Delos, the best contribution remains Reger (1994). In particular, pp. 51–53 emphasize the important role played by the sanctuary of Apollo as an economic actor. For several

examples of Delian documents, with French translation and a concise commentary, see Prêtre et al. (2002). For the structure of the accounts, see Migeotte (2014, 592–596).

⁸ For the lists of citizens: Vial (2008). For the list of aliens: Tréheux, de Délös, and Index. Tome I. (1992). For the list of artisans: Feyel; for a synopsis of the estate rents: Reger (1994, 309–349) and Pernin (2014, 233–251).

⁹ For the number of Delian citizens in 173 BCE, we follow Bruneau (1970, 262–263), as corrected by Vial (1984, 18–20). This approach is consistent with the ones normally accepted for the Classical world (Varinlioglu 1986, 22), cf. *Classical Review* XXXVIII (1988), 124 and *The Journal of Hellenic Studies* CIX (1989), 244, and it has the advantage of providing a figure that also takes into account persons absent from the event for which attendance is recorded. On the uncertainty of population estimates in antiquity, see Lavan (2019, 91–111). For a more recent approach than Ruschenbusch (1985), see Hansen (1985, 11–13) and Hansen (2006, 55) for the upper bound. See Scheidel (2003, 123) for the lower bound. The growth rate of 0.35% is 0.05 percentage points higher than the one assumed by Mackil (2023), in consideration of the fact that Delos seems to have been an expanding community. Vial (1984, 17) observes that in 262, the population must have exceeded 612 citizens because there were 600 members of the court (*heliea*) and 12 magistrates. Our estimated population for 262 BCE is 879 citizens, and ranges from 960 when assuming a population growth rate of 0.25% to 769 when assuming a population growth rate of 0.50%. Reger (1994, 83–84) postulated that the population growth remained the same throughout the independence (see also Chankowski 2019, 268–269).

¹⁰ For female asset ownership in Delos: Vial (1984, 78, 288). In particular, we note that due to the nature of the documentation and the society of the time, women are hardly visible in the documents we used. Women could not act as guarantors, nor could they lease or rent land. In the context of financial transactions, women were required to have a male guarantor, except for donations. From the perspective of this study, however, the limited economic data pertaining to women are nevertheless included, as they are attributed to the male intermediary. As for the issue of slavery, we concur with Bresson (2015, 476 n. 7), that demography is extremely difficult to quantify, and that makes ancient inequality substantially different from modern ones. For the maximum share of slaves in the population, see Scheidel (2004a); for the minimum share of slaves, see Scheidel (2004b) and Scheidel (2011).

¹¹ It is complicated to write an economic history of skilled labor in the ancient world, and Delos is no exception, despite the wealth of evidence available. This difficulty does not affect our research, as our focus is not on the specific remuneration for individual tasks, but on the overall sum involved in the compensation for manual work, that is, in the total compensation and number of people involved.

¹² For the second period, we propose an alternative scenario in which Delian society is disaggregated into five groups and we attribute wealth to each group on the basis of data obtained through house size comparisons. The results are in line with our main results (compare Table 4 with Table B1).

¹³ Mackil (2023, 62) suggests 15% as a possible maximum percentage of metics over the free population (including women), allowing for huge spatial and temporal differences. Our proposals, max. 12.9% metics over the free male population, are well within that range.

¹⁴ The share of individuals without wealth (about 30%) may seem high compared to early modern times, when it reached a level of 14% as in 15th century Florence and ranged between 17.9% and 32% in 15th century Prato (Alfani and Ammannati 2017, 1094; Alfani 2022, 30). For the ancient world, our share is supported by Friesen (2004, 344), which estimates that 28% of the population of urban settings in the Roman empire were “incapable of earning a living” and “permanently in crisis through wage fluctuations and low wages” (25% by Longenecker 2009, 263). Both estimates are based on Whittaker (1993, 301–333).

¹⁵ See also Vial (1984, 340–341). Recent paleogeographic research shows that the main harbor infrastructure was improved in the period from the end of the III century BCE to the end of the II century BCE (Desruelles et al. 2023).

¹⁶ About the transition from a mostly agricultural to a commercial economy during the independence. See Vial (1984, 317–356), Osborne (1988, 300–303), and Reger (1994, 259–264).

References

- Alfani, G. 2021. “Economic Inequality in Preindustrial Times: Europe and Beyond.” *Journal of Economic Literature* 59, no. 1: 3–44.
- Alfani, G. 2022. “Epidemics, Inequality, and Poverty in Preindustrial and Early Industrial Times.” *Journal of Economic Literature* 60, no. 1: 3–40.
- Alfani, G., and F. Ammannati. 2017. “Long-Term Trends in Economic Inequality: The Case of the Florentine State, c. 1300–1800.” *Economic History Review* 70, no. 4: 1072–1102.
- Alfani, G., and A. Carballo. 2023. “Income and Inequality in the Aztec Empire on the Eve of the Spanish Conquest.” *Nature Human Behavior* 7, no. 8: 1265–1274.
- Alfani, G., and M. Di Tullio. 2019. *The Lion's Share: Inequality and the Rise of the Fiscal State in Preindustrial Europe*. Cambridge University Press.
- Bagnall, R. S. 1992. “Landholding in Late Roman Egypt: The Distribution of Wealth.” *Journal of Roman Studies* 82: 128–149.
- Bogaard, A., S. Ortman, J. Birch, et al. 2024. “The Global Dynamics of Inequality (GINI) Project: Analysing Archaeological Housing Data.” *Antiquity* 80, no. 397: 1–7.
- Borgerhoff Mulder, A., I. Fazzio, W. Irons, et al. 2010. “Pastoralism and Wealth Inequality: Revisiting an Old Question.” *Current Anthropology* 51: 35–48.
- Bowles, S., and W. Carlin. 2020. “Inequality as Experienced Difference: A Reformulation of the Gini Coefficient.” *Economics Letters* 186: 1–3.
- Bresson, A. 2015. *The Making of the Ancient Greek Economy: Institutions, Markets and Growth in the City-States*. Princeton University Press.
- Brughmans, T., and A. Wilson, eds. 2022. *Simulating Roman Economies: Theories, Methods, and Computational Models*. Oxford University Press.
- Bruneau, P. 1970. *Recherches sur les cultes de Délos à l'époque hellénistique et à l'époque impériale*. Les Belles Lettres.
- Burford Cooper, A. 1977–1978. “The Family Farm in Ancient Greece.” *Classical Journal* 73: 162–175.
- Cesaratto, S. 2024. “Surplus Approach and Institutions: Where Sraffa Meets Polanyi.” *Journal of Economic Issues* 58, no. 3: 989–1011.
- Chankowski, V. 2019. *Parasites du Dieu: Comptables, financiers et commerçants dans la Délos hellénistique*. École française d'Athènes.
- Chirikure, S., R. Nyamushosho, F. Bandama, and C. Dandara. 2018. “Elites and Commoners at Great Zimbabwe: Archaeological and Ethnographic Insights on Social Power.” *Antiquity* 92, no. 364: 1056–1075.
- Constantakopoulou, C. 2017. *Aegean Interactions. Delos and Its Networks in the Third Century*. Oxford University Press.
- Desruelles, S., A. Chabrol, C. Hasenohr, et al. 2023. “Palaeogeographic Reconstruction of the Main Harbour of the Ancient City of Delos (Greece).” *Journal of Archaeological Science* 160: 105857.
- Duncan-Jones, R. 1982. *The Economy of the Roman Empire: Quantitative Studies*. Cambridge University Press.
- Feyel, C. 2006. *Les artisans dans les sanctuaires grecs aux époques classique et hellénistique à travers la documentation financière en Grèce*. École française d'Athènes.
- Flohr, M. 2017. “Quantifying Pompeii: Population, Inequality, and the Urban Economy.” In *The Economy of Pompeii*, edited by M. Flohr and A. Wilson, 53–86. Oxford University Press.
- Fochesato, M., A. Bogaard, and S. Bowles. 2019. “Comparing Ancient Inequalities: The Challenges of Comparability, Bias and Precision.” *Antiquity* 93, no. 370: 853–869.
- Foxhall, L. 1992. “The Control of the Attic Landscape.” In *Agriculture in Ancient Greece*, edited by B. Wells, 155–159. P. Åströms förlag.
- Foxhall, L. 2007. “Olive Cultivation in Ancient Greece.” In *Seeking the Ancient Economy*. Oxford University Press.
- Friesen, S. J. 2004. “Poverty in Pauline Studies: Beyond the So-Called New Consensus.” *Journal for the Study of the New Testament* 26, no. 3: 323–361.
- Gallego, J. 2017. “Riqueza Y Desigualdad en la Atenas del Siglo IV A.C.” In *Capital, Deuda Y Desigualdad: Distribuciones de la Riqueza en el Mediterráneo Antiguo*, edited by M. Campagno, J. Gallego, C. G. García, and M. Gaw, 79–101. Miño y Dávila Editores.
- Gauthier, P. 2011. “Études d'histoire et d'institutions grecques.” In *Choix d'écrits*. Droz.
- Glötz, G. 1913. “Le prix des denrées à Délos.” *Journal Des Savants* 11, no. 2: 16–29.
- Hansen, M. H. 1985. *Demography and Democracy. The Number of Athenian Citizens in the Fourth Century B.C.* Systime.
- Hansen, M. H. 2006. “The Demography of the Greek City-State Culture.” In *The Shotgun Method: The Demography of the Ancient Greek City-State Culture*. University of Missouri Press.
- Hanson, V. D. 1995. *The Other Greeks: The Family Farm and the Agrarian Roots of Western Civilization*. Free Press.
- Heichelheim, F. 1930. *Wirtschaftliche Schwankungen der Zeit von Alexander bis Augustus*. Fisher.
- Jew, D., and M. Lavan. 2023. “The Uncertain Past.” In *Probabilistic Modelling in Ancient History*, edited by M. Lavan, D. Jew, and B. Danon, 1–50. Cambridge University Press.
- Kohler, T. A., and M. E. Smith. 2018. *Ten Thousand Years of Inequality: The Archaeology of Wealth Differences*. University of Arizona Press.
- Kron, G. 2011. “The Distribution of Wealth at Athens in Comparative Perspective.” *Zeitschrift für Papyrologie Und Epigraphie* 179: 129–138.
- Kron, G. 2014. “Comparative Evidence and the Reconstruction of the Ancient Economy: Greco-Roman Housing and the Level and Distribution of Wealth and Income.” In *Quantifying the Greco-Roman Economy and Beyond*, edited by F. de Callatay, 123–146. Edipuglia.
- Kuznets, S. 1955. “Economic Growth and Income Inequality.” *American Economic Review* 45, no. 1: 1–28.
- Lalueza-Fox, C. 2022. *Inequality: A Genetic History*. MIT Press.
- Lavan, M. 2019. “Epistemic Uncertainty, Subjective Probability, and Ancient History.” *Journal of Interdisciplinary History* 50, no. 1: 91–111.
- Longenecker, B. W. 2009. “Exposing the Economic Middle: A Revised Economy Scale for the Study of Early Urban Christianity.” *Journal for the Study of the New Testament* 31, no. 3: 243–278.
- Mackil, E. 2023. “Assessing the Scale of Property Confiscation in the Ancient Greek World.” In *The Uncertain Past: Probability in Ancient History*, edited by M. Lavan, D. Jew, and B. Danon, 53–92. Cambridge University Press.
- Migeotte, L. 2014. *Les finances des cites grecques aux périodes Classique et hellénistique*. Les Belles Lettres.
- Milanovic, B. 2006. “An Estimate of Average Income and Inequality in Byzantium Around Year 1000.” *Review of Income and Wealth* 52, no. 3: 449–470.

- Milanovic, B. 2016. *Global Inequality: A New Approach for the Age of Globalization*. Harvard University Press.
- Milanovic, B., P. H. Lindert, and J. G. Williamson. 2007. "Measuring Ancient Inequality." NBER Working Papers 13550, 1–86.
- Modalsli, J. 2015. "Inequality in the Very Long Run: Inferring Inequality From Data on Social Groups." *Journal of Economic Inequality* 13: 225–247.
- Morris, I. 2000. *Archaeology as Cultural History. Words and Things in Iron Age Greece*. Blackwall.
- Morris, I. 2009. "The Greater Athenian State." In *The Dynamics of Ancient Empires. State Power From Assyria to Byzantium*, edited by I. Morris and W. Scheidel, 99–157. Oxford University Press.
- Murray, S. C., and S. Bernard, eds. 2024. *Models, Methods and Morality: Assessing Modern Approaches to the Greco-Roman Economy*. Cham, Switzerland.
- North, D. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge University Press.
- Ober, J. 2015. "Classical Athens." In *Fiscal Regimes and the Political Economy of Premodern States*, edited by A. Monson and W. Scheidel, 492–592. Cambridge University Press.
- Ober, J., and W. Scheidel. 2022. "Inequality." In *The Cambridge Companion to the Ancient Greek Economy*, edited by S. Von Reden, 404–420. Cambridge University Press.
- Osborne, R. 1988. "Social and Economic Implications of the Leasing of Land and Property in Classical and Hellenistic Greece." *Chiron* 18: 279–324.
- Pernin, I. 2014. *Les baux ruraux en Grèce ancienne: corpus épigraphique et étude*. MOM Éditions.
- Piketty, T. 2014. *Capital in the Twenty-First Century*. Harvard University Press.
- Prêtre, C., J.-C. Moretti, M. Brunet, and V. Chankowski. 2002. *Comptes et Inventaires de Délos*. École française d'archéologie d'Athènes.
- Reger, G. 1994. *Regionalism and Change in the Economy of Independent Delos, 314–167 BC*. University of California Press.
- Ruschenbusch, E. 1985. "Die Zahl der Griechischen Staaten und Arealgrösse und Bürgerzahl der Normalpolis." *Zeitschrift für Papyrologie Und Epigraphic* 59: 253–263.
- Scheidel, W. 2003. "The Greek Demographic Expansion: Models and Comparisons." *Journal of Hellenic Studies* 103: 120–140.
- Scheidel, W. 2004a. "Human Mobility in Roman Italy, I: The Free Population." *Journal of Romance Studies* 94: 1–26.
- Scheidel, W. 2004b. "Creating a Metropolis: A Comparative Demographic Perspective." In *Ancient Alexandria Between Egypt and Greece*, edited by W. V. Harris and G. Ruffini, 1–31. Brill.
- Scheidel, W. 2011. "The Roman Slave Supply." In *The Cambridge World History of Slavery, 1: The Ancient Mediterranean World*, edited by K. Bradley and P. Cartledge, 287–310. Cambridge University Press.
- Scheidel, W. 2017. *The Great Leveler*. Princeton University Press.
- Scheidel, W., and S. J. Friesen. 2009. "The Size of the Economy and the Distribution of Income in the Roman Empire." *Journal of Romance Studies* 99: 61–91.
- Tréheux, J. 1992. *Inscriptions de Délos. Index. Tome I. Les étrangers, à l'exclusion des Athéniens de la cléruchie et des Romains*. Académie des Inscriptions et Belles-Lettres.
- Trümper, M. 1998. *Wohnen in Delos: eine baugeschichtliche Untersuchung zum Wandel der Wohnkultur in hellenistischer Zeit*. Verlag Marie Leidorf.
- Van Wees, H. 2011. "Demetrius and Draco. Athens' Property Classes and Population in and Before 317 BCE." *Journal of Hellenic Studies* 131: 95–114.
- Van Zanden, J. L. 1995. "Tracing the Beginning of the Kuznets Curve: Western Europe During the Early Modern Period." *Economic History Review* 48, no. 4: 643–664.
- Varinlioglu, E. 1986. *Die Inschriften von Keramos*. Dr. Rudolf Habelt GMBH.
- Vial, C. 1984. *Délos indépendante (31–167 avant J.-C.)*. Étude d'une communauté civique et de ses institutions. de Boccard.
- Vial, C. 2008. *Inscriptions de Délos. Index. Tome II. Les Déliens*. Académie des Inscriptions et Belles-Lettres.
- Whittaker, C. R. 1993. *Land, City, and Trade in the Roman Empire*. Ashgate.
- Will, E. 2003. *Histoire politique du monde hellénistique (323–30 av. J. C.)*. Éditions de Seuil.
- Zarmakoupi, M. 2022. "Shaping the City of Late Hellenistic Delos." *Journal of Ancient Architecture* 1: 65–85.

Appendix A

Summary of the Methodology

Appendix B

Alternative Specification of the Gini for the Late Independence Period

In the main text, the population of Delos is divided into three groups. In this appendix, we propose a more detailed breakdown of Delian society using a social table approach. This approach suffers from an important limitation, namely that we can operate it only for the late independence period because the share of wealth is based on house size data, available only for the latter period. For this reason, such an approach does not allow for diachronic comparisons between Gini values, and has the function of corroborating the reliability of our estimates more than providing alternative results.

There are five groups we introduce in this alternative categorization. Group 1 includes individuals attested to political offices that presuppose the highest level of material wealth, such as prodaneistai and hieropoi, and who correspond to 10.1% of the population. Group 2 includes individuals attested to economic motives that presuppose a high level of material wealth, such as owners of commercial buildings and tenants of sacred lands, and correspond to 16.6% of the population. Group 3 includes individuals attested to political offices that presuppose an intermediate level of material wealth, such as presidents of the assembly and choregoi, and correspond to 17.1% of the population. Group 4 includes individuals attested to economic motives that presuppose an intermediate level of material wealth, such as artisans and architects, and correspond to 28.6% of the population. Finally, Group 5 includes all other individuals not directly attested in the inscriptions and corresponds to 31.9% of the population (see Table B1).

To assign wealth to Groups 1–4, we rely on the size distribution of the 91 dwellings attested for Delos by Trümper (1998), assigning the first 15 houses to Group 1, the second 15 to Group 2, the third 22 to Group 3, and the remaining to Group 4. The resulting Gini is 0.345. This level of Gini is very much in line with our Gini for the late independence period (0.374) and also with the Gini based on the same house size data of Trümper (1998) by Kron (2014) (0.35).

TABLE A1 | Key figures and assumptions.

Parameter	Parameter	Minimum	Most likely	Maximum	References
Panel A: Early Independence (Period II: 288–263 BCE)					
Annual growth rate (%)	<i>g</i>	0.25%	0.35%	0.5%	Hansen (1985, 11–13) and Hansen (2006, 55) for the maximum of 0.5%; Scheidel (2003, 123) for the minimum. Both estimates refer to population growth rates of ancient Greece.
Population of Delian citizens c. 275 BCE	<i>p</i>	930	840	722	Sum allocated for gift meals in the festival for Poseidon in the year 173 BCE, given the cost of a single meal (1200 citizens). Retropolation of the total population of the late independence assuming a yearly growth rate of population of 0.35%.
Population of metics	<i>m</i>		72		Own results based on the list of aliens of Tréheux (1992)
Slaves (%)	<i>sl</i>	10	15	20	Scheidel (2004a, 292) for minimum of 10% and Scheidel (2004b) for maximum of 20% in urban Roman Empire (15% intermediate).
Population of Group 1 (excl. metics)	<i>e</i>	130	246	341	Own results based on the list of citizens of Vial (2008) and prosopographical observations of Vial (1984).
Population of Group 2 (excl. metics)	<i>n</i>	221	316	431	Own results based on the list of citizens of Vial (2008) and prosopographical observations of Vial (1984).
Population of Group 3	<i>u</i>	278	278	278	Subtraction: $p - e - n$.
Wealth of Group 1 (%)	$1 - s$	80.4	70.7	60.9	Share of rent value of sacred land owned by Group 1 sacred land tenants over total rent value.
Wealth of Group 2 (%)	<i>s</i>	19.6	29.4	39.1	<i>Minimum</i> : Minimum mean rent value of remunerations in Period II. <i>Most likely</i> : Average of mean rent value of sacred land owned by Group 2 and mean value of remunerations in Period II. <i>Maximum</i> : Mean rent value of sacred land owned by Group 2 in Period II.
Panel B: Late Independence (Generation V: 210–185 BCE)					
Annual population growth rate (%)	<i>g</i>	0.25%	0.35%	0.5%	Hansen (1985, 11–13) and Hansen (2006, 55) for the maximum of 0.5%; Scheidel (2003, 123) for the minimum. Both estimates refer to population growth rates of ancient Greece.
Population of Delian citizens c. 197 BCE	<i>p</i>	1130	1103	1065	Sum allocated for gift meals in the festival for Poseidon in the year 173 BCE, given the cost of a single meal (1200 citizens). Retropolation of the total population of the late independence assuming a yearly growth rate of population of 0.35%.
Population of metics	<i>m</i>		52		Own results based on the list of aliens of Tréheux (1992).
Slaves (%)	<i>sl</i>	10	15	20	Scheidel (2004a, 292) for minimum of 10% and Scheidel (2004b) for maximum of 20% in urban Roman Empire (15% intermediate).
Population of Group 1 (excl. metics)	<i>e</i>	180	328	451	Own results based on the list of citizens of Vial (2008) and prosopographical observations of Vial (1984).
Population of Group 2 (excl. metics)	<i>n</i>	284	406	555	Own results based on the list of citizens of Vial (2008) and prosopographical observations of Vial (1984).
Population of Group 3	<i>u</i>	370	370	370	Subtraction: $p - e$ (max Group 1) – n (min Group 2)
Wealth of Group 1 (%)	$1 - s$	62.8	51.7	46.0	Share of rent value of sacred land owned by Group 1 sacred land tenants over total rent value.
Wealth of Group 2 (%)	<i>s</i>	37.2	48.3	54.0	<i>Minimum</i> : Minimum mean rent value of remunerations across Periods V and VI (Period VI). <i>Most likely</i> : Average of mean rent value of sacred land owned by Group 2 and mean value of remunerations in Periods V and VI. <i>Maximum</i> : Mean rent value of sacred land owned by Group 2.

TABLE B1 | Resulting estimates according to the alternative Gini approach.

Group	Population	% Population	Wealth (m ²)	% Wealth	Gini
1	127	11.0	8124	38.4	0.345
2	131	11.3	5050	23.9	
3	198	17.1	3439	16.3	
4	331	28.6	4523	21.4	
5	368	42	0	0	

Note: ^aThe population includes metics, which have been assigned to the groups according to the same criteria adopted for citizens (N.B. according to our criteria, metics could not belong to Group 1.1 since they could not hold the highest offices).

Source: Our study and Trümper (1998).