Uncorrelated Inequalities: A Multiproxy Measure for Household Archaeology

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Abstract

Inequality has received increased attention in the social sciences since the 1990s, in part because of the harm it causes and because it is avoidable. Bolstered by the Gini coefficient, a quantitative measure of unevenness in a distribution that enhances comparative studies across time and space, archaeologists have expanded the study of inequality in recent years. Many of these investigations use multiple variables to assess inequality. A challenge of such multi-proxy studies is that simply averaging Gini coefficients for multiple variables can over-represent inequality in societies where variables for inequality are not correlated. This paper introduces the Domain Sensitive Gini (DSG) and applies it to a sample of archaeological case studies with extensive domestic excavations. The DSG helps disambiguate societies where wealth variables are aligned from societies where such variables are not aligned. In cases where variables do not align, different forms of wealth are not strongly correlated: a household that is poor in one domain might be wealthy in other domains. The DSG also suggests that inequality is lower than estimates based on averaged variables. This finding is valuable when set within a broader comparative context because it shows that high inequality seen today is not natural and that ancient case studies are relevant.

Key words: Inequality, households, Gini coefficient, Maya

Statements and Declarations
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Introduction

Increased academic concern with inequality dates back to the 1990s, when social scientists noticed dramatic increases in wealth disparities (Grusky and Kanbur, 2006). Governments, international organizations, and media paid increased attention by about 2015 when institutions such as the United Nations and the International Monetary Fund recognized inequality as a major threat to sustainable development (Philips, 2020:29-30). Though inequality within developed countries had been on the decline for the first three quarters of the twentieth century, due in part to progressive taxation, destruction of wealth from world wars, and burgeoning state investment in education, healthcare, social security, etc., it has grown sharply since the 1980s (Milanovic, 2016:4, Piketty, 2014, 2021:7-8). Within less-developed countries, globalization has led to explosive growth of inequality over the past four decades (Hung, 2021:7). In 2019, the wealth of the 26 richest people on the planet exceeded that of the entire lower 50% of the world's population combined (Philips, 2020:14). The COVID-19 pandemic exacerbated the situation (Franklin et al., 2020:757).

The uptick in inequality gained attention not because of such gaudy trivia, but because of the deep and multi-faceted harm it causes. Wilkinson and Pickett (2009:494) highlight strong associations between greater income inequality and poor educational performance, low social capital, low birth weight, and higher rates of suicide, teen pregnancy, mental illness, homicide, violent crime, imprisonment, drug overdose, obesity, hostility, and racism. Nobel Prize Winner Joshep Stiglitz (2012:xii) writes that extreme inequality results in an "economic system that is less stable and less efficient, with less growth" and fewer opportunities for social mobility (see also Cunha Neves et al., 2016). High inequality imperils democratic governance and often results in political violence, civil wars, revolutions, financial crises, and social movements (Deaton, 2014; Rau and Stokes, 2025). Millhauser (2023) presents evidence for the negative impact of high inequality and precarity in Mesoamerica: communities that occupied marginalized land in the Basin of Mexico during the Late Aztec period were doubly marginalized in the post-Conquest era.

One of the reasons why social scientists take great interest in inequality is that massive inequality is not inevitable. Rather, political ideology affects it (Stiglitz 2012). "Inequality does not follow a deterministic process…There are powerful forces pushing alternately in the direction of rising or shrinking inequality. Which one dominates depends on the institutions and policies that societies choose to adopt" (Piketty and Saez, 2014:841). If inequality is a "social, historical, and political construction" (Piketty, 2022:9), then people can deconstruct it. Archaeology shows that societies have devised creative strategies for constraining inequality (Ames, 2010; Graeber and Wengrow, 2021; Jennings 2016; Hodder, 2022; Weissner, 2002). Indeed, cross-cultural comparison suggests that collective action can reduce inequality (Blanton and Fargher, 2008). This finding motivates recent research that attempts to understand the degree to which variation in how people govern themselves affects the amount of inequality in ancient societies is (Carballo and Feinman, 2016; Hutson et al., 2024; Kohler et al., 2018). Synthetic analysis reveals that at the regional level, trends in inequality are neither linear nor uniform, and not necessarily tied to population growth (Feinman et al. 2025).

This paper contributes to these discussions by developing and applying a method for quantifying degrees of inequality. Researchers in many disciplines find that inequality is difficult to measure. Different ways of measuring lead to paradoxical conclusions. For example, one country's inequality compared to another can diminish at the same time that inequality within that country increases (Hung, 2021; Sen, 2006:21). Poverty can climb drastically even when a country officially moves from “poor” to “middle income" (Philips, 2020:12). Archaeologists have joined discussions of inequality by utilizing a variety of methods. Some studies assess inequality by calculating Gini coefficients for a single variable (e.g. Kohler et al. 2025). Other studies featured in this journal (Arponen et al. 2016; Munson and Scholnick 2022) use multiple variables and emulate an approach to well-being developed by Nobel prize winner Amartya Sen (1993). In some societies, multiple proxies are closely correlated, therefore allowing a single Composite Archaeological Index (CAI) to characterize inequality more generally (Oka et al. 2018). Yet in other societies, one measure of wealth does not correlate with another. Here, well-being is dispersed among different domains. This is sometimes the case among the ancient Maya of eastern Mexico and northwestern Central America. In these cases, a composite index that averages Gini scores for multiple variables over-estimates inequality. This situation merits exploration of a measure that is sensitive to different domains. This paper proposes such a method—the Domain Sensitive Gini (DSG)—and applies it to case studies from the Maya area (figure 1). Maya societies make a useful context given their notoriety for high inequality and autocratic governance. If the DSG is to be trusted, it shows that some Maya societies had less inequality than is suggested by the CAI. Archaeologists might replicate this finding in other parts of the world.

Fig. 1 Map showing location of Maya sites mentioned in the paper

Inequality

Researchers mean different things when they discuss inequality and how to measure it. Sen (1980) recognizes that using a single measure of inequality, such as income, often fails to capture variation in quality of life for two reasons. First, well-being is multi-faceted, involving basic concerns such as nourishment, clothing, and shelter but also outcomes that income does not directly capture, such as social respect, career fulfillment, political voice, and opportunities for women (Sen, 1993, 2006:35; see also Drydyk, 2005; Nussbaum, 2005). Second, within any particular society, individual people and groups "differ a good deal from each other in the weights they attach" to particular values and the contentment they derive from income or other physical goods (Sen, 1993:39; Stewart, 2005). If different people derive value and contentment from different domains, then any assessment of well-being requires multiple measurements (Piketty, 2022:22). Sen's argument helped shape the United Nations Development Programme's (UNDP) Human Development Reports, which, beginning in 1990, recognized the importance of not just financial wealth, but also a society's health, human rights, creativity, political freedom, and more (UNDP, 1990). The UNDP created the Human Development Index (HDI) as an explicitly multidimensional measure of the standard of living, combining income, literacy and life expectancy (Grusky and Kanbur, 2006:11). Yet the debate over how to measure well-being has not been settled. Nussbum (2005:171) defends a list of ten fundamental human entitlements or rights that should be protected irrespective of local culture while Sen (2005:157) argues that a one-size-fits-all, predetermined, canonical list of capabilities cannot be specified independent of cultural context. I am sympathetic to the claim that packaging multiple variables into a single measure (which is what I do in this paper) might misrepresent qualitative differences in experience. Nevertheless, comparison at a larger scale, the bread and butter of fields ranging from public health to conservation ecology to development economics (Millhauser 2024), requires objective measures.

Many anthropologists take multi-dimensional approaches to well-being (e.g. Fischer 2014), though with variations in how to define and measure inequality. Bowles and coauthors (2010) define inequality as "persistent ascribed differences in access to economic resources and other valued ends." Such resources and ends, which Borgerhoff Mulder and coauthors (2009) gloss as "wealth", can vary widely, leading them to recognize three broad categories of difference: material (physical entities that are limited but desired), relational (breadth and depth of social connections), and embodied (health, skill, knowledge). Since well-being entails the accomplishment of (or ability to pursue) material, relational, and embodied expectations (see also Narotzky and Besnier 2014:S4), inequality can also be measured as unevenness in well-being (or intentionally rendered less visible, e.g. Chase and Chase 2009). In archaeology, Munson and Scholnick (2022) emphasize that inequality must include disparities in social and somatic resources, not just material wealth or income (see also Arponen et al. 2016; Hutson 2023). Along these same lines, Twiss and coauthors (2024:2-3) recognize that wealth takes many forms, though they highlight different categories--economic disparities, political distinctions, and ritual differentiations—as measured through subsistence income, productive capacity, symbolic elaboration, and prestigious personal goods at Çatalhöyük. Additional multiproxy studies in archaeology include Feinman and colleagues' (2018) examination of obsidian, bone, house size, patio size, and terrace size in the Valley of Oaxaca and Nishimura's (2023) exploration of 13 variables, including architecture, artifacts and burials, from Bronze Age Titriş Höyük, (see also Fochesato et al., 2019; Stone, 2018; Oka et al., 2018; Wright 2014). Kay and coauthors (2022) take a slightly different approach to inequality, challenging the idea that the accumulation of material necessarily leads to well-being and empowerment. Instead, for Kay and coauthors, the connection between accumulation of material and the constraints and possibilities for human life is mediated by how value can be transformed fluidly in practice. Kohler and coauthors (2018, 2025) differ from the abovementioned studies in using a single variable to measure inequality: house surface area. They relate this univariate measure to the three kinds of wealth (material, relational and embodied) discussed by Borgerhof Mulder and coauthors (2009), though house size was not among Borgerhof Mulder and coauthors' 42 variables.

An additional point prompted by Sen's work is that different households within the same society may value (and derive contentment from) different goals; some invest in elaborate houses, others in portable wealth, others in ritual. To quote Munson and Scholnick (2022:4) "what people value in life (e.g., what they strive 'to be and do') differs not only between societies but within them as well." Thus, we need a measure of inequality that accommodates case studies where households that rank highly in some variables rank lower in others. Twiss and coauthors borrow the term heterarchy to refer to situations when rankings among households change substantially depending on which variable for inequality is used. A more hierarchical situation occurs when most measures of inequality align, which is to say when some households are poor in most or all ways and others are rich in most or all ways.

Drennan and Peterson (2006, 2012; Drennan et al., 2010; Peterson and Drennan, 2018; Peterson et al., 2016) provide a sustained engagement with the question of whether or not inequalities within a society align. At the Hongshan (4500-3000 BCE) site of Fushanzhuang, in the Chifeng region of China, they find two separate but uncorrelated hierarchies: one of wealth—as indicated by finely made and better finished ceramics—and one of status (Drennan et al., 2010:59) or prestige (Peterson et al., 2016:209)—as indicated by decorated pottery. Likewise, at Yuchisi, a Late Dawenkou (3500-2600 BCE) central place in Anhui province, China, personal adornment, which Peterson and coauthors equate with prestige, does not correlate with serving vessels and fine-paste ceramics, which they equate with wealth. Along these lines, studies from Çatalhöyük show that the houses with the most burials and symbolic elaboration (such as bucrania) are not the houses with the most surface area or the most storage space (Hodder, 2022:623; Kay et al., 2022). Furthermore, Kohler and Higgins' (2016) comparison of house size and storage space among ancestral Puebloans suggests to them a distinction between wealth and income

On the other hand, during the Guadalupe phase (900-700 BCE) at Fábrica San José, a village in the Valley of Oaxaca, "status and wealth are intertwined…and this integrated system of ranking emerges strongly from the household evidence" (Drennan et al., 2010:62). Likewise, at Dadiwan, a large, Late Yangshao period (4000–3000 BCE) settlement in Gansu province, China, households with greater wealth also have greater indicators of status; wealth and status were unified into a single, clear axis (Peterson et al., 2016:206, 210). Whether inequality in wealth or status is concealed or visible to others is an interesting question explored elsewhere (Chase and Chase 2009).

The contrast between societies where variables for wealth and prestige align versus societies where they do not align also exists in the Maya area. A clear example comes from Tikal and Chunchucmil, a pair of cities with large populations (about 13,000 in Tikal's central 16 km^2 [Culbert et al. 1990] and upwards of 30,000 in Chunchucmil's central 15 km^2 [Hutson et al., 2017:120]) at approximately the same time (between 550 and 770 CE for Tikal [Haviland, 2003:124-129; 2014:131] and between 400 to 630 CE for Chunchucmil [Jiménez et al., 2017]). Both cities feature central marketplaces (Jones, 2015; Dahlin et al., 2007). At Tikal, access to obsidian, access to seashell, and assemblage diversity are all positively correlated (Hutson, 2020a:72-3). At Chunchucmil, residential floor area, architectural volume, access to obsidian, fancy pottery, and other resources are not correlated (Hutson, 2020a:72-3). The lack of correlations at Chunchucmil can be interpreted as a case in which different households had the freedom to pursue different pathways to well-being. Inequalities existed, but they are "domain-specific" (Kay et al., 2022:584) at Chunchucmil. While some households invested more in material wealth, others invested more in social wealth. Finally, craft specialization sometimes correlates with wealth, but not always. In cases like Fábrica San José and Tikal, richer households specialize in craft production. Yet excavations at Early Bronze age III (2850-2550 BCE) Numayra, Jordan, and 7th century CE Cerén, El Salvador show that specialization leads not to clear inequality but rather to horizontal differentiation and degrees of interdependency (Oka et al., 2018:87; Sheets, 2020).

Methods

Whereas sites like Fábrica San Jose, Tikal, and Dadiwan exhibit clean, homogeneous hierarchies, where measures of inequality "travel together" (Twiss et al. 2024:22), the findings at Fushanzhuang, Yuchisi, Chunchucmil, Numayra, and Ceren exhibit domain-specific inequalities that are not correlated, akin to "a rich mosaic of varied relationships—cooperative, competitive, or conflictive" (Peterson and Drennan, 2016:220). Inequality among households in the second list of sites is not as hierarchical as inequality in the first list of sites. Those who believe it is useful to compare levels of inequality in different societies will require a measure that is multivariate and can distinguish sites where inequality is domain-specific (e.g. settlements where different measures of well-being are not correlated) from sites where inequality is homogeneous and hierarchical. Drennan and Peterson (2006) use multi-dimensional scaling, which creates visual representations of how individual households differ from each other along multiple axes of variation. While useful for understanding the rich mosaic of human striving at a particular settlement, multi-dimensional scaling plots are not as useful for quantitative comparisons of inequality across multiple settlements.

Oka and coauthors (2018:73) present a multi-variate method, which they call the Composite Archaeological Inequality index (CAI), for measuring what they refer to as "general inequality." The CAI is the geometric mean of the Gini coefficients of each of the variables for well-being. A Gini coefficient is a measure of unevenness in the distribution of an entity (Drennan and Peterson 2018:39). If that entity is a measure of wealth, the Gini can measure inequality. The geometric mean is the nth root of the product of all variates, where n equals the number of variables. Geometric means tend to be slightly smaller than arithmetic means, which divide the sum of variates by the total number of variates. Oka and colleagues (2018) prefer the geometric mean because it can dampen the effect of outliers. By aggregating multiple measures of well-being, the CAI takes inspiration from the HDI and therefore recognizes that inequality is a multi-dimensional phenomenon. Yet in cases like Yuchisi and Chunchucmil, where variables for inequality are not correlated, the CAI misrepresents the nature of inequality. For example, in a single society, some households might invest heavily in elaborate houses, others in portable wealth, and others in ritual. In this society, if households each have relatively equal resources but a third of them spend heavily on architecture, another third on personal adornments, and the final third on incense burners, Gini coefficients for each of these three variables (architecture, adornments, and censers) will be high. Averaging these Gini coefficients will yield a large value for the CAI, suggesting a high degree of what Oka and coauthors call "general inequality." Yet this suggestion is not correct: households in this settlement have relatively equal resources but expend them in different ways.

In order to disambiguate case where measures of inequality are domain specific from cases where measures of inequality travel together, I present the Domain Sensitive Gini (DSG). Unlike measures that average Gini coefficients for multiple variables, the DSG helps distinguish societies in which different forms of inequality correlate with each other (when households that score highly on one variable tend to score highly on most others) from societies in which inequalities are not correlated (when households that score highly on one variable score less highly on others). While the unit of analysis in the current study is the domestic compound (understood to be the archaeological remains of a household), the DSG can be applied to other units. Figure 2 contains a workflow for calculating the DSG. Calculating the metric begins with assembling values for each domestic compound for each variable (house size, access to fancy pottery, etc.). For each variable, all variates are converted into scores between 0 and 100, such that the domestic compound with the highest value for a variable receives a 100 for that variable. Scaling between 0 and 100 does not paper over substantive differences of absolute scale, as discussed in the supplementary materials, though it does give each value equal weight, which, as I discuss in the supplementary material, can have negative consequences. After converting variates to scores between 0 and 100 for each variable, each domestic compound's scaled scores are summed and a Gini coefficient is calculated from the sums of scores.

Fig. 2: Workflow for calculating the Domain Sensitive Gini

I will demonstrate the DSG method using data from six variables measured on 113 domestic compounds at Chunchucmil. The first variable, amount of obsidian, is a potential measure of wealth since obsidian is a long-distance trade good (the nearest source is over 600 km away as the crow flies) that requires resources to obtain. The values for this variable range from 0 to 30.4 grams. A household with no obsidian, such as S5W5a (Op. 110), gets a score of 0. The household with 30.4 grams of obsidian—N3E3h (Op. 152)—receives a score of 100. A household with 10.1 grams of obsidian, which is a third of the way between 0 and 30.4, would receive a score of 33. The values for the second variable, the amount of fancy pottery (measured in grams), range from 0 to 386. Domestic compound N3E3h has 55 g of fancy pottery, thus receiving a score of 14.3. Moving to a third variable, volume of architecture, values range from 15.8 to 5337.6 m^3, such that 15.8 converts to a score of 0.003 and 5337.6 converts to a score of 100. N3E3h has a volume of 1292.9 m^3, which converts to a score of 24.22. [See the Supplementary materials for the acceptability of using variables with and without zero values]. Following the same procedure, N3E3h would receive scores for the remaining three variables (surface area of houses, amount of metates, and amount of depressions). N3E3h's scores for the six variables would then be summed, as would the scores for each of the other 112 domestic compounds. The Gini coefficient for these 113 summed scores is 0.357. This is the DSG.

This particular Gini score—0.357—is remarkable given that the Gini scores for each of the six variables range from 0.465 to 0.725. The arithmetic mean of these six Gini scores is 0.556, while the geometric mean (the CAI) is 0.550 (see table 1). Thus, the DSG, which is attentive to domain-specific inequalities, shows overall inequality to be substantially lower than when calculated simply by averaging Gini scores. I argue that the DSG is more accurate because, unlike the arithmetic or geometric (CAI) means of Gini scores, it takes into account cases in which variables for well-being are not correlated with each other.

Table 1: Summary of data.

Site	Domain Sensitive Gini (DSG)	Upper limit of 95% confidence interval of CGS	Arithmetic mean of Gini coefficients	Geometric mean of Gini coefficients (CAI)	Domestic surface area Gini coefficient	n variables	n cases
Chunchucmil	0.357	0.401	0.556	0.550	0.465	6	113
Uxul	0.548	0.624	0.692	0.682	0.471	9	10
Mayapan	0.367	0.534	0.6	0.582	0.367	9	8
Tikal	0.496	0.581	0.616	0.602	0.455	4	34
Copan	0.28	0.379	0.475	0.451	0.193	9	9

Two additional methodological challenges remain. First, in much of the world, including the Maya area, getting robust multivariate data requires broad and costly household excavations. The shortcoming of the Chunchucmil example used above is that most of the data come from test pitting. Of the 113 residential groups in the sample, the average surface area of excavation was 7.5 m^2 (this figure does not include the few groups that received horizontal excavations). While Peterson and co-authors (2016:201) maintain that relatively minor excavations can “provide large samples of artifacts for comparative analysis”, other studies show that test pitting, as opposed to broader excavations, can miss important aspects of ancient household organization, production, and consumption (Masson and Peraza Lope, 2014:336). I therefore use the DSG on case studies with extensive household excavations. The obvious trade-off is that, due to the high cost of extensive excavations, the few case studies with well-reported household data have relatively small sample sizes of excavated houses. To mitigate the issue of small sample sizes, which result in artificially low Gini coefficients, I report Ginis calculated in RStudio using the DescTools package, which corrects small sample size bias following the procedure presented by Deltas (2003). On average, the corrected Gini coefficients are 0.059 higher than the uncorrected values, with a standard deviation of 0.023. I also provide the 95% confidence intervals for the

DSGs. Ideally, excavated residential compounds within a particular site should date to the same time period so that they are part of the same society. To avoid a palimpsest effect that muddies interpretation, household materials should also come from relatively short occupation spans. Maya sites with such chronological control and with extensive, well-published excavations in domestic contexts include Uxul (n=10), Mayapan (n=8) and Copan (n=9) (figure 1). Tikal also has extensive household excavations but with a less focused chronology; I have added Tikal for comparison. Excavation materials come largely from household debris but offerings are also included when present since offerings also consume items of value.

The second challenge is that the ways that people choose to fulfil desires differ from settlement to settlement, making comparison difficult. To quote Bowles and co-authors (2010:9), “wealth takes different forms in each population." In archaeology, while no two settlements will have the same proxies for inequality, this does not mean that we will forever be comparing apples to oranges (Chase et al. 2023). The resources and valued ends that people privilege from one society to another may differ, but the patterns in the distribution of resources can be compared. Thus, as long as the variables represent forms of wealth as defined above, they can be admitted in a multi-dimensional study of inequality even if the variables are not the same from one settlement to another. In fact, using the same variables for each site would impoverish the analysis. For example, copper came to the Maya area too late to be consumed by Classic period households at Copan, Uxul, and Tikal, but it is an important and valued good at Postclassic Mayapan (Paris 2008). Not including copper among the variables for Mayapan simply because it can’t be included as a variable at the other sites unnecessarily weakens the analysis at Mayapan. Given differences in the nature of the data from each site, the absolute numbers of variables per case study are not identical. Yet three of the four case studies with extensive excavations (Tikal being the exception) have either eight or nine variables. The hope is that this relatively consistent number of variables for each settlement will provide robust overall portraits of equality. Applying the DSG to other sites will require identifying variables appropriate for those sites and analysis of the sensitivity of the DSG to changes in variables. The following section addresses the appropriateness of the variables used in this study.

Variables

This section describes how each variable used in this study relates to the different kinds of wealth that can be distributed unequally. Some variables are measured at more than one site. Many variables pertain to what Bowles and coauthors (2010) would refer to as material wealth though some variables, such as incense burners and musical instruments, have relational and embodied aspects. The supplementary materials contain citations to the data sources.

Architectural volume (Uxul): Volume of construction captures the costs of material and labor (and therefor indexes material and relational wealth) more accurately than surface area (Smith et al. 2014:312). Two houses with the same surface area may represent very different expenditures if one is built on a voluminous platform and the other is not. Nevertheless, volume may depend on occupational length (see Hutson 2016:151–152, 2020b:411–412).

Architectural labor investment (Copan): This complex variable, related to architectural volume, is described at greater length in the supplementary material.

Assemblage Diversity (Tikal). Canonical texts in the archaeology and anthropology of inequality emphasize that wealthier households “possess a greater variety or diversity of material goods” (Smith 1987:319). While marketplace exchange can neutralize this effect, Haviland (2014) has noted the correlation between assemblage diversity and wealth for Tikal and his observations have been replicated (see Hutson 2020b). Assemblage diversity at Tikal is quantified as non-ceramic artifacts per square meter of excavation.

Basalt grinding stones/metates (Copan): Most ground stone tools at Copan were made from widely available rhyolite. Basalt outcrops are infrequent in the Copan Valley (Gerstle 1988:227). Basalt metates have long been recognized as a desirable but limited resource in the Maya lowlands (Rathje and Leone 1972).

Bifaces (chert and obsidian) (Mayapan, Copan): Few artisans possessed the knowledge required to produce bifaces and appropriate raw material needed to be imported from long distances.

Bone, worked (Copan): The worked bone artifacts included here consist of ornamental or decorative items such as "perforated mandibles and teeth, and bone beads, rings, and tubes (the latter may include musical flutes)" (Gerstle 1988:213).

Chert (Mayapan): Good quality chert is not a locally available resource at Mayapan and had to be imported from the Puuc hills to the south or further afield such as Northern Belize. To avoid overlap with the biface variable, chert bifaces are not tallied in Mayapan's chert variable.

Figurines (Uxul, Copan): Figurines in Mesoamerica were used in various contexts, including fertility rituals, ancestor veneration, child's play, burial offerings, cache deposits, and more. Insofar as figurines function as "important components of religious observation" (Hendon 1991:911), they entail ceremonial knowledge (see also Barnard 2021:274), a form of embodied wealth. Figurines are relatively rare at Uxul (0.5 figurines or fragments per 1000 ceramic sherds; Barnard 2021: table 6.47). I have included this variable for Copan because 70% of the figurines and whistles were imported (Gerstle 1988:115-117) and because Coner phase inhabitants placed "considerable importance" on the use and possession of figurines (Hendon 1991:909).

Incense Burners (Uxul, Mayapan): Incense burners are closely linked to ritual practices such as ancestor veneration, cleansing, initiation and termination rituals, and more (Barnard 2021:279). Incense burners comprise less than 3% of the full amount of sherds reported for the eight households at Mayapan (Peraza Lope and coauthors 2021:243). They are therefore a limited material good and also presume a degree of sacred knowledge and embodied wealth in terms of the training and expertise needed for proper ceremonial performance.

Jadeite (Uxul): Mayanists do not debate the high symbolic value and desirability of jadeite, which is geologically rare (Freidel et al. 2002; Taube 1998).

Marine shell (Uxul, Mayapan, Tikal): Marine shell is a limited resource since it is not locally available at any of the sites in this study (Masson and Peraza Lope 2014:314). Several authors have argued that marine shell was a status good with profound political, social and economic value in Maya societies ranging from the Preclassic to the Postclassic (Freidel et al. 2002; Hohmann et al, 2018:118; Isaza Aizpurúa and McAnany 1999). Barnard (2021:253) refers to it as a precious material used to make ornaments. Hohmann and coauthors (2018:117) note that shell's "predominance in Maya ritual offerings indicates that some were highly valued and imbued with ritual significance." Ethnohistoric accounts name shell beads as a form of currency during the contact period, and it is likely that they served the same function two centuries earlier at Mayapan (Freidel et al. 2002). Common representations of shell as tribute supports their status as a wealth good in the Classic period (Houston 2000:173).

Metal artifacts (Mayapan): Research on metal artifacts at Mayapan (Paris 2008) strongly suggests that they are a luxury good and therefore a useful variable for studying different forms of inequality.

Musical instruments (Uxul): Whistles, ocarinas, drums, and trumpets are special purpose artifacts that are rare and difficult to manufacture. They therefore indicate material wealth but also suggest embodied wealth since their possession entails the skill and training required for musical performances; Barnard (2021:277) considers them part of ceremonial practice.

Obsidian (Uxul, Mayapan Tikal): Acquisition of obsidian therefore required resources and it is desirable for many tasks because it is sharper than cutting tools made from locally available flint. The jury is still out regarding whether or not obsidian in the Central Maya Lowlands during the Late Classic should be considered a wealth good (Rice 1987). Some sites have a lot (Tikal; Moholy-Hagy 1989) while others, such as nearby Calakmul (Braswell 2013) have less, though newer excavations may change this. Uxul has more than Calakmul (Barnard 2021:231, table 6.36) but is not located near obsidian sources. Although obsidian was relatively common at Tikal, closer scrutiny of the distribution of obsidian within lower status residences shows that it is positively correlated with other variables for wealth (Hutson 2020b). Recent projects at Mayapan have recovered over 6,000 obsidian artifacts (Escamilla and Delgado Kú 2021) but Mayapan is located a very long distance (over 600 km as the crow flies) from obsidian sources. At several sites located much closer than Mayapan to obsidian sources, obsidian is associated with wealth and inequality (Meierhoff et al. 2012; Bijac Phase Copan, Aoyama 2001).

Portable ornaments (Copan): Ornaments as reported in Hendon (1987) consist of a variety of materials, predominantly jades, slate batons, “stone ornaments”, ceramic jewelry, and marine shell jewelry. Each of these ornaments were of limited circulation either due to the exotic nature of the raw material or the artisanry required to craft them.

Pottery, fancy (Uxul, Mayapan): Finely made pottery is often correlated with wealth (Drennan et al. 2010). Fancy pottery at Uxul consists of polychromes, which Barnard (2021:199) regards as an expensive resource. Polychromes comprise a small portion of the pottery at Uxul. Polychrome workshops are often restricted to elite contexts (Reents-Budet et al. 2000).

At Mayapan. fancy pottery comprises less than 2% of the full amount of sherds reported for the eight households used in this study (Peraza Lope et al. 2021:243). This is therefore a limited good and some types, such as Pele polychrome, were highly valuable and likely not available at the marketplace (Peraza Lope et al. 2021:247), suggesting the need for both material and relational wealth.

Pottery, Imported (Mayapan): Imported pottery is distinct from fancy pottery at Mayapan. Since no sherds are counted as both fancy and imported, there is no overlap in these two datasets. Imported pottery, as reported by Peraza Lope and coauthors (2021:243) comprises approximately 0.6% of the full amount of sherds reported for the eight households used in this study. Although imported pottery is the rarest category of pottery found at Mayapan, sherds from the only definitively imported type, Matillas Fine Orange, were found in most household contexts, suggesting their availability at a marketplace (Peraza Lope et al. 2021:249). Yet amounts of this rare and presumably costly type varied significantly across households, suggesting differences in how households invested their resources.

Pottery, imported and fancy (Copan**):** Imported fancy pottery makes up about 6% of the pottery of the Coner phase residential groups in the Copan sample. While fancy pottery does not necessarily require extra labor to produce, the skill set for producing it was more limited and the fact that it was an import further limited its availability. Imported fancy pottery was reported as a percentage of total fancy pottery (Hendon 1991:908).

Residential surface area (Uxul, Mayapan, Tikal, Copan): Archaeologists in Mesoamerica often observe a correlation between house size and wealth (Folan et al. 2009; Haviland and Moholy-

Nagy 1992; Carmean et al. 2011; Tourtellot et al. 1992). Houses with larger surface area require more material, time, and labor to construct (Smith et al. 2014:312). While people may also build larger houses because they need more space for people or storage, these concerns also involve inequality since an increase in residents means greater access to labor and more storage means possession of more resources (Kohler et al. 2025).

Sculpture (Copan): Architectural sculpture at Copan, which, in the case of structure 9N-82c, in patio 9N-8a, includes inscribed writing that names a titled lord, is a clear marker of social status but required relational, embodied, and material resources to materialize. The data are the number of buildings per group with sculpture.

Results: Applying the Domain Sensitive Gini

Uxul, located in the Central Maya Lowlands of Campeche, Mexico, was a secondary center heavily influenced by enormous Calakmul, located 32 km to the northeast (Grube et al., 2012). While Uxul has occupation dating to the first Millennium BCE, excavations reveal that most of its structures were built and occupied between 650 and 750 CE (Barnard, 2021:57), when it housed several thousand people. Thus, the residential contexts have reasonable chronological control, though the sample is likely not representative of the site as a whole given that no small residential compounds were excavated extensively. Drawing on data published by Barnard (2021), I included nine variables in the analysis: residential surface area, architectural volume, and amounts of obsidian, jadeite, polychrome pottery, marine shell, incense burners, figurines, and musical instruments (table 2, Supplementary table 1). For the latter seven variables, I calculated Gini scores based on raw values as well as values per 1000 excavated Late

Classic sherds. Standardizing per 1000 sherds is justified by the fact that the proportions of the domestic compounds that were excavated vary substantially at Uxul. This means that raw amounts of artifacts such as shell and obsidian could be a function of the quantity of excavation. Standardizing by the amount of pottery might distort the results, however, because amount of pottery could be tied to wealth.

Table 2: Uxul Gini coefficients for individual variables

Variables	Gini coefficients
Volume of architecture	0.609
Surface area of architecture	0.471
Greenstone artifacts	0.742
Obsidian	0.795
Shell	0.861
Polychrome sherds	0.556
Musical instruments	0.709
Figurines	0.711
Incense burners	0.778

The results show that standardizing artifact quantities by the number of sherds makes a big difference. When using raw artifact counts, without standardization, the artifact variables (obsidian, jadeite, polychrome pottery, figurines, musical instruments, marine shell), with the exception of incense burners, are almost all correlated with each other (table 3a); none of the artifact variables have significant correlations with architectural volume and surface area. When standardizing artifact counts by the number of sherds excavated, all of these correlations between artifacts disappear (see table 3b). This means that, in general, households that consume more highly-valued goods are also consuming lots of regular pottery. Thus, regular pottery is probably tied to wealth, which means that standardizing by the consumption of regular pottery muddles the analysis. For raw artifact counts, the DSG is 0.548 (the 95% confidence limits are 0.458 and 0.624) and the average of the nine Gini coefficients is 0.692 (CAI = 0.682, table 1; figure 3a, 4). The DSG for standardized variables is 0.264 (the 95% confidence limits are 0.188 and 0.371) and the average of the nine Gini coefficients is 0.540 (CAI is 0.527).

Fig. 3: Lorenz curves the sum of scaled variable scores.

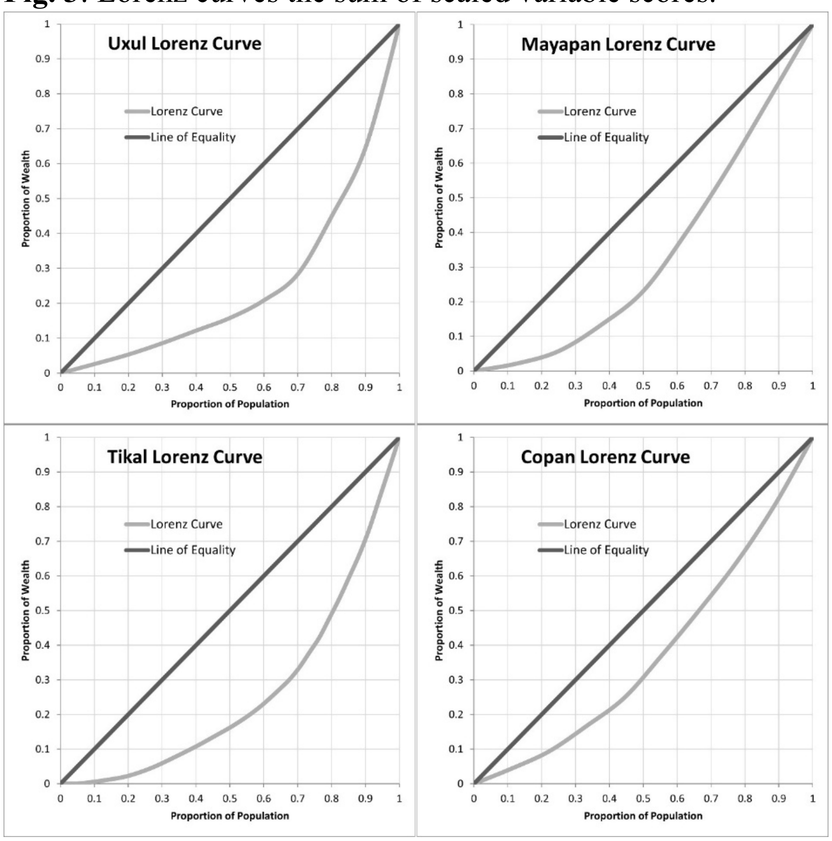
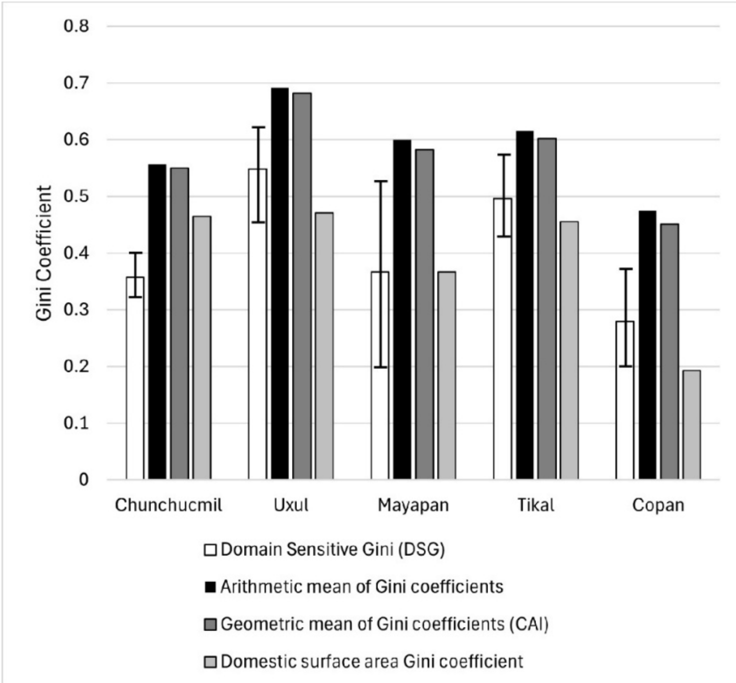


Fig. 4: DSGs with 95% confidence intervals in the context of average Ginis and surface area Ginis from the same sites



The fact that the arithmetic and geometric means of the Gini scores for raw and standardized counts of artifacts are above the 95% confidence limit of the DSGs shows that these different measures of inequality—DSGs vs. means of Ginis—are not closely aligned. Compared to the other cases discussed below, Uxul's DSG for raw counts is the highest. This is in line with the fact that Uxul's variables exhibit a number of positive correlations (table 3a). The higher DSG and large number of correlations between variables are intriguing given Barnard's (2021:172-173) finding that domestic compounds with substantial architecture at Uxul did not have better access to ceremonial facilities, water sources, and other services. This finding contrasts with common patterns (Dennehy et al., 2016; Stanley et al., 2016). The lack of correlation between substantial architecture and access to ceremonial facilities and water sources suggests that inequality was quite domain-specific or heterarchical and makes more sense if we put greater stock in the substantially lower DSG (0.264) calculated on the basis of the standardized data.

Table 3a: Uxul Correlation Matrix using raw counts of artifacts

		Volume	Surface area	Polychrome sherds	Obsidian	Greenstone	Total shell	Figurines	Incense burners
Surface area	Kendall's Tau	.911**							
	Sig. (2-tailed)	0.000							
Polychrome sherds	Kendall's Tau	0.022	0.022						
	Sig. (2-tailed)	0.929	0.929						
Obsidian	Kendall's Tau	0.111	0.111	0.467					
	Sig. (2-tailed)	0.655	0.655	0.060					
Greenstone	Kendall's Tau	0.070	0.070	.768**	.722**				
	Sig. (2-tailed)	0.784	0.784	0.003	0.005				
Total shell	Kendall's Tau	-0.156	-0.156	.733**	.733**	.768**			
	Sig. (2-tailed)	0.531	0.531	0.003	0.003	0.003			
Figurines	Kendall's Tau	0.090	0.090	.674**	.809**	.683**	.674**		
	Sig. (2-tailed)	0.719	0.719	0.007	0.001	0.008	0.007		
Incense burners	Kendall's Tau	0.256	0.349	0.070	0.210	0.293	0.163	0.141	
	Sig. (2-tailed)	0.316	0.171	0.784	0.412	0.265	0.523	0.583	
Musical instruments	Kendall's Tau	0.135	0.045	.719**	.539*	.848**	.629*	.659**	0.235
	Sig. (2-tailed)	0.590	0.857	0.004	0.031	0.001	0.012	0.009	0.360

Table 3b: Uxul Correlation Matrix with artifacts standardized per 1,000 sherds

		Volume of architecture	Surface area of architecture	Polychormes per 1000 sherd LC	Obsidian per 1000 sherds	Jadeite per 1000 sherds	Shell per 1000 sherds	Figurines per 1000 sherds	Incense burners per 1000 sherds
Surface area of architecture	Kendall's Tau	0.911							
	Sig. (2-tailed)	0.000							
Polychormes per 1000 sherds	Kendall's Tau	-0.333	-0.422						
	Sig. (2-tailed)	0.180	0.089						
Obsidian per 1000 sherds	Kendall's Tau	0.244	0.244	-0.378					
	Sig. (2-tailed)	0.325	0.325	0.128					
Jadeite per 1000 sherds	Kendall's Tau	-0.046	-0.046	0.138	0.368				
	Sig. (2-tailed)	0.856	0.856	0.586	0.146				
Shell per 1000 sherds	Kendall's Tau	-0.378	-0.378	0.600	0.022	0.460			
	Sig. (2-tailed)	0.128	0.128	0.016	0.929	0.069			
Figurines per 1000 sherds	Kendall's Tau	0.000	0.000	0.135	0.405	0.465	0.360		
	Sig. (2-tailed)	1.000	1.000	0.590	0.106	0.068	0.151		
Incense burners per 1000 sherds	Kendall's Tau	0.045	0.045	-0.315	0.045	-0.070	-0.225	-0.250	
	Sig. (2-tailed)	0.857	0.857	0.209	0.857	0.785	0.369	0.321	
Musical instruments per 1000 sherds	Kendall's Tau	-0.067	-0.156	0.378	-0.200	0.414	0.333	0.135	0.000
	Sig. (2-tailed)	0.788	0.531	0.128	0.421	0.102	0.180	0.590	1.000

Mayapan, located in the northern Maya lowlands of Yucatan, Mexico, was the capital of a political confederacy from 1250 CE to 1450 CE and the largest Maya center of its time, reaching a population of about 15,000 (Masson and Peraza Lope, 2014; Masson et al., 2021). Broad-scale excavations of eight domestic compounds show relatively short occupations and the sample of eight is representative in the sense that it includes what the excavators identify as both elites and commoners, some with craft specialization and some without. I included nine variables in the analysis: residential surface area and amounts of obsidian, chert bifaces, other chert artifacts, fancy pottery, imported pottery, incense burners, marine shell, and metal artifacts (table 4, supplementary table 2). The Gini coefficient for house surface area (0.367) resembles the Gini coefficient (0.32) calculated by Brown and colleagues (2012) with a sample of 1214 houses at Mayapan. Table 5 shows the 36 correlation coefficients for these variables, of which seven are significantly positive. The arithmetic mean of the Gini coefficients for these nine variables is 0.600, with a CAI of 0.582 (table 1). The DSG is 0.367 (figure 3b, 4) with 95% confidence limits of 0.201 and 0.535. Like Uxul, the averages of the Gini scores are above the upper 95% confidence limit of the DSG, suggesting that Mayapan is a case where different measures of inequality do not travel together.

Table 4: Mayapan Gini coefficients for individual variables

Variable	Gini coefficient
Obsidian artifacts	0.575
Shell artifacts	0.524
Ritual sherds	0.751
Fancy sherds	0.532
Imported sherds	0.483
Chert bifaces	0.553
Other chert artifacts	0.726
Surface area of architecture	0.367
Metal artifacts	0.891

Table 5: Mayapan Correlation Matrix

		Obsidian artifacts	Marine shell	Incense burner sherds	Fancy sherds	Imported sherds	Chert bifaces	Chert not counting bifacess	Metal
Marine shell	Kendall's tau	.714*							
	Sig. (2-tailed)	0.013							
Incense burner sherds	Kendall's tau	-0.071	-0.214						
	Sig. (2-tailed)	0.805	0.458						
Fancy sherds	Kendall's tau	.786**	0.500	0.000					
	Sig. (2-tailed)	0.006	0.083	1.000					
Imported sherds	Kendall's tau	.714*	.571*	0.071	.786**				
	Sig. (2-tailed)	0.013	0.048	0.805	0.006				
Chert bifaces	Kendall's tau	-0.182	0.109	-0.109	-0.255	-0.036			
	Sig. (2-tailed)	0.533	0.708	0.708	0.383	0.901			
Chert not counting bifaces	Kendall's tau	0.357	.643*	0.143	0.143	0.357	0.473		
	Sig. (2-tailed)	0.216	0.026	0.621	0.621	0.216	0.105		
Metal	Kendall's tau	-0.077	-0.077	0.386	-0.231	-0.077	0.039	0.309	
	Sig. (2-tailed)	0.797	0.797	0.199	0.441	0.797	0.897	0.304	
Surface area	Kendall's tau	-0.036	0.255	-0.036	-0.109	0.109	.593*	0.473	0.354
	Sig. (2-tailed)	0.901	0.383	0.901	0.708	0.708	0.044	0.105	0.245

Copan, located in the southern lowlands in western Honduras, is one of the best-known Maya sites. It was a city state capital with a peak population of 20,000 people and an extensive corpus of hieroglyphic inscriptions centered on a dynasty with at least 16 consecutive kings. Copan benefits from several projects focused on household archaeology (for example Landau, 2016; Webster and Gonlin, 1988). I use data from the Proyecto Arqueológico Copan II, directed by William Sanders from 1981 to 1985, because it featured complete and well-published excavations of households from all four status ranks, all within the city and all dated to the Late Classic Coner Phase (650-820 CE). The sample consists of nine patio groups (see Supplementary table 3). While some of these groups are part of larger architectural compounds, such as 9N-8, the "repeated occurrence" of basic household activities at each patio group "suggests that each patio functioned as a separate social-residential unit" (Hendon, 1991:904; see also Hendon, 1987: 488-489). I used nine variables: residential surface area, architectural labor investment, extent of sculpture, imported fancy pottery, quantity of portable ornaments, figurines, bifacial projectile points, worked bone and basalt grinding stones/metates (table 6). I expected these variables to be correlated given that Fash (2005:96) notes that the "quality of the architecture, graves and tombs, and associated domestic artifacts generally correspond quite well" with the size of domestic compounds at Copan (see also Richards-Risetto, 2023). However, only six of the 36 potential correlations were statistically significant (table 7) and some of these correlations are not intuitive (for example, number of figurines and bifacial points). Copan's DSG is 0.280 (95% confidence limits are 0.200 and 0.379), which is significantly lower than the arithmetic mean (0.475) and geometric mean (0.451) of the Gini scores for the nine variables (Table 1, Figure 4).

Table 6: Copan Gini coefficients

Variable	Gini coefficient
Architectural labor investment	0.457
surface area of structures	0.193
Extent of sculpture	0.694
Imported fancy pottery	0.408
Quantity of portable ornaments	0.572
Figurines	0.488
Chert and obsidian bifaces	0.425
Proporiton of basalt grinding stones	0.44
Worked bone	0.595

Table 7 Copan correlation matrix

		Architectural labor investment	Residential surface area	Extent of scuplture	Imported fancy pottery	Portable ornaments	Figurines	Chert and obsidian bifacial points	Worked/ decorated bone
Residential surface area	Kendall's Tau	$.556^{*}$							
	Sig. (2-tailed)	0.037							
Extent of scuplture	Kendall's Tau	$.738^{**}$	0.545						
	Sig. (2-tailed)	0.010	0.057						
Imported fancy pottery	Kendall's Tau	0.444	0.222	$.609^{*}$					
	Sig. (2-tailed)	0.095	0.404	0.033					
Portable ornaments	Kendall's Tau	-0.114	0.229	0.099	0.057				
	Sig. (2-tailed)	0.673	0.399	0.734	0.833				
Figurines	Kendall's Tau	0.056	0.167	0.096	0.389	0.114			
	Sig. (2-tailed)	0.835	0.532	0.737	0.144	0.673			
Chert and obsidian bifacial points	Kendall's Tau	0.000	0.111	0.032	0.333	0.057	$.833^{**}$		
	Sig. (2-tailed)	1.000	0.677	0.911	0.211	0.833	0.002		
Worked/ decorated bone	Kendall's Tau	0.056	0.167	0.096	0.500	0.229	$.778^{**}$	$.611^{*}$	
	Sig. (2-tailed)	0.835	0.532	0.737	0.061	0.399	0.004	0.022	
Proportion of basalt grinding stones	Kendall's Tau	-0.222	-0.222	-0.417	0.000	-0.114	0.167	0.222	0.278
	Sig. (2-tailed)	0.404	0.404	0.145	1.000	0.673	0.532	0.404	0.297

Tikal, located in Peten district of Guatemala, is a very large Maya city with regional political clout rivalled only by the Kaan dynasty of Calakmul/Dzibanche. As noted above, domestic contexts at Tikal were not as broadly excavated compared to Uxul, Copan, and Mayapan. Furthermore, whereas the domestic occupations at the other sites generally span 200 years or less, many of the domestic compounds at Tikal had much longer occupations, amplifying a palimpsest effect that injects more caveats into the interpretation of inequality. Another potential problem is that Tikal has only half the variables as the other sites with extensive excavations (composite indices tend to stabilize with more variables: Oka et al., 2018:90). These variables are architectural surface area, assemblage diversity, obsidian, and marine shell (see table 8 and supplementary table 4). Given large variation in the amount of excavation at each residential context, I standardized the latter three variables by m^2 of excavation. Finally, the excavation sample only includes non-elite domestic compounds (recall that the Uxul sample is biased toward large compounds). Despite these downsides, I include Tikal because it provides a case where several variables for wealth are correlated (see table 8 Supplementary table 4). In other words, inequalities travel together at Tikal (Hutson 2020a). The DSG for Tikal is 0.496 (table 1, figure 3d; the 95% confidence limits are 0.433 and 0.601). The arithmetic and geometric means of the Gini scores are 0.616 and .602, both of which are beyond the upper 95% confidence limit of the DSG. Such scores would be higher if the excavation sample contained elite households.

Table 8: Tikal correlation matrix

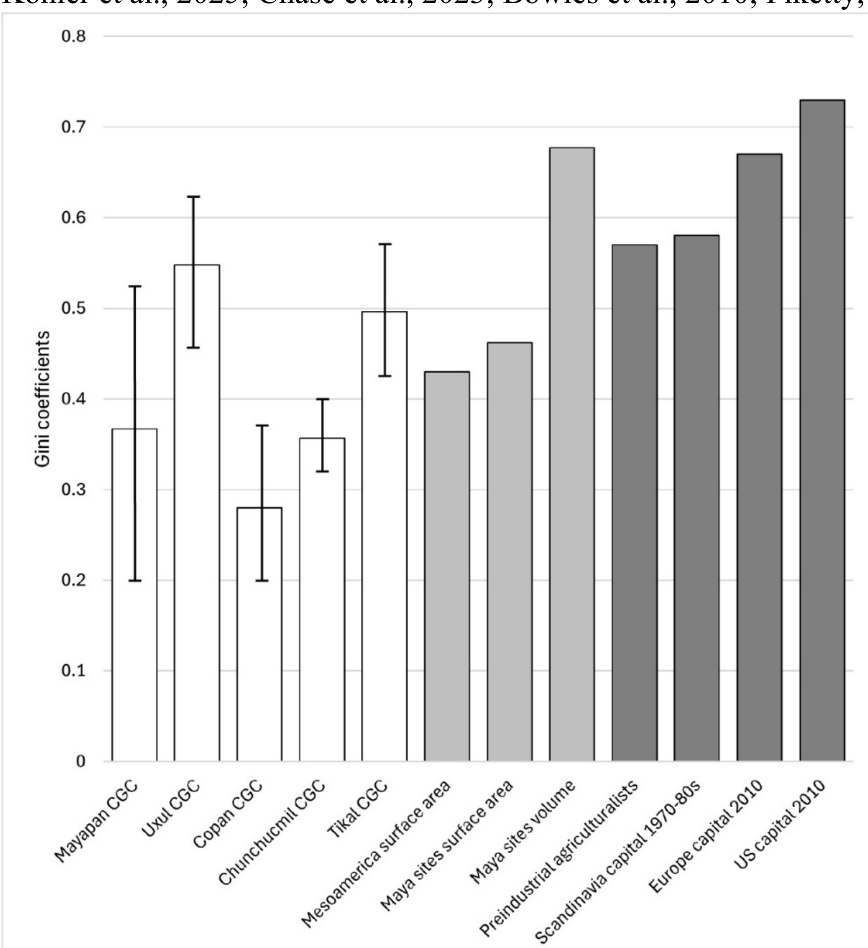
		Assemblage diversity (types per m^2 of excavation)	Obsidian artifacts per m^2 excavation	Marine Shell artifacts per m^2 of excavation
Obsidian artifacts per m^2 excavation	Pearson Correlation	0.514		
	Sig. (2-tailed)	0.002		
Marine shell artifacts per m^2 of excavation	Pearson Correlation	0.748	0.578	
	Sig. (2-tailed)	< 0.0001	0.0003	
Architectural surface area (m^2)	Pearson Correlation	-0.013	0.207	-0.048
	Sig. (2-tailed)	0.942	0.239	0.786

Discussion and Conclusions

When put into broader context, the DSGs for the four sites with extensive household excavations reveal a number of points. First, figure 4 clearly shows that arithmetic and geometric means for the Gini scores are all significantly higher than the DSGs. This is also the case for Chunchucmil. This indicates that averaging Gini scores tends to over-represent inequality. Figure

4 also shows that in cases where variables for well-being are more closely aligned, such as Uxul and Tikal, there is a smaller difference between the DSG and the arithmetic and geometric means of the Gini coordinates. Stated differently, the gaps between the DSG and the arithmetic and geometric means are larger in those cases such as Mayapn, Copan, and Chunchucmil, where there are fewer correlations between variables. Figure 5 provides a clearer picture of the fact that DSGs are higher in cases like Uxul and Tikal where inequalities travel together: households that score highly for one measure tend to score highly in other measures. At the other three sites, variation in one resource counteracts variation in another measure, evening out and dampening overall inequality.

Fig. 5 DSGs with 95% confidence intervals in comparative context (other data taken from Kohler et al., 2025; Chase et al., 2023; Bowles et al., 2010; Piketty, 2014)



Regarding Copan, Mayapan, and Chunchucmil, one might wonder how it can be that variables tied to wealth are not strongly correlated. A straightforward explanation is that people have similar amounts of resources but choose to invest them in different pursuits. For example, if it takes wealth both to build a larger house and to acquire fancy pottery, these two variables can be uncorrelated if some households choose to invest resources in architecture and others choose to invest resources in pottery. Following Amartya Sen (1980) and Ted Fischer (2014), there might be multiple ways to find fulfilment within a particular society. Different people might value different pursuits, resulting in a lack of correlation. In such a case when variables for inequality do not travel together and the DSG is lower, we might conclude that well-being is more broadly distributed.

Many recent studies take a univariate approach to inquality, focusing on house surface area. Figure 4 shows that in three of the four cases with broad horizontal excavation, the gini for house surface area is within the 95% confidence interval of the DSGs. For all five cases represented in figure 4, the Domain Specific Gini coefficients are closer to the Gini coefficients for house surface area than they are to the arithmetic and geometric means of the Ginis. Yet whereas the DSGs are always smaller than the arithmetic and geometric means of the Ginis, the DSGs are sometimes smaller than the Ginis for house surface area and sometimes larger. In some cases the lower scores yielded by the DSG align with relatively low univariate Gini scores for house surface area at Caracol (Chase et al. 2023), Coba (Hutson et al. 2023) and Teotihuacan (Smith 2023). Perhaps the most interesting finding regarding house surface area is that in the four cases with broad-scale excavations, house surface area is almost never significantly correlated with any of the other variables. This should prompt researchers to think carefully about the meaning of house surface area on a case by case basis.

Expanding the sample of house surface area Gini coefficients to the 15 sites reported by Chase and coauthors (2023) shows that Gini coefficients for domestic surface area in the Maya area vary substantially, from 0.32 to 0.7, with an average of 0.46 (Figure 5). This average is similar to the average Gini for house surface area for 155 sites in Mesoamerica more broadly (Figure 5; Kohler et al. 2025).

Figure 5 places the DSGs in a more recent and global context of capital ownership. The intensive agriculturalist Gini of 0.57 reported by Shenk and coauthors (2010) represents an average of land and livestock Gini coefficients from four historic societies: East Anglians, Kipsigis, Krummhörn, and Yomut. The three recent Ginis for capital ownership in Scandinavia (0.58), Europe (0.67) and the United States (0.73) are taken from data presented by Piketty (2014). Though capital ownership captures wealth inequality more accurately than measures of inequality based on income from labor, it suffers from the shortcoming of all single proxy measures: many other factors beyond capital (freedom of artistic and political expression, availability of education, etc.) contribute to well-being. Nevertheless, it is notable that these Ginis are always higher (and often beyond the 95% confidence intervals) than the DSGs from the ancient societies in this study. This is important because studies that largely limit samples of "preindustrial" societies to the 18th and 19th centuries risk drawing the oversimplified conclusion that "income inequality in pre-industrial countries today is not very different from inequality in distant pre-industrial times" (Milanovic et al., 2011:268). Feinman and coauthors show that "different historical paths are empirically evident, and they reveal patterns and trends that are neither uniform nor linear" (Feinman et al., 2025:6; see also Green et al. 2025; Jennings 2016). Once again, contemporary analysts can learn from ancient societies.

Taken together, the data from Figure 4 suggest that inequality of material well-being as represented by the DSGs in some ancient Maya societies is over-estimated by existing Gini measures while the data in Figure 5 suggest that inequality in some ancient Maya societies was significantly lower than in other societies. The results and comparisons presented in this paper underscore the need for a method for disambiguating societies in which variables for well-being are correlated from societies in which they are not correlated. The DSG provides this method while also suggesting the existence of relatively low levels of inequality even in urban, state-level societies. In the context of research that shows the devastating effects of growing inequality, this latter finding adds yet another voice challenging the notion that high inequality is inevitable. While the small sample sizes in this paper demand humility and caution, the hope is that the paper will stimulate methodological experimentation in other multi-proxy data-sets from broadly excavated domestic contexts.

Supplementary materials: Rationale for variable selection and presentation of household data

Data Availability Statement: Data used in this paper derive from previously published sources.

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