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Ancient Inequality

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Abstract

Is inequality largely the result of the Industrial Revolution? Or, were pre-industrial incomes as unequal as they are today? For want of sufficient data, these questions have not yet been answered. This paper infers inequality for 29 ancient, pre-industrial societies using what are known as *social tables*, stretching from the Roman Empire 14 AD, to Byzantium in 1000, to England in 1688, to Nueva España around 1790, to China in 1880 and to British India in 1947. It applies two new concepts in making those assessments – what we call the *inequality possibility frontier* and the *inequality extraction ratio*. Rather than simply offering measures of inequality, we compare its observed level with the maximum feasible inequality (or surplus) that could have been extracted by the elite. The results, especially when compared with modern poor countries, give new insights into the connection between inequality and economic development in the very long run.

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1. Good Questions, Bad Data?

Is inequality largely a byproduct of the Industrial Revolution? Or, were pre-industrial incomes as unequal as they are today? How does inequality in today's least developed, agricultural countries compare with that in ancient, agricultural societies dating back to the Roman Empire? Did some parts of the world always have greater income inequality than others? Was inequality augmented by colonization? These questions have yet to be answered, for want of sufficient data.

Simon Kuznets was very skeptical of attempts to compare income inequalities across countries when he was writing in the 1970s. In his view, the early compilations assembled by the International Labor Organization and the World Bank referred to different population concepts, different income concepts, and different parts of the national economy. To underline his doubts, Kuznets once asked (rhetorically) at a University of Wisconsin seminar "Do you really think you can get good conclusions from bad data?" Economists with inequality interests are indebted to Kuznets for his sage warning.[1] We are even more indebted to Kuznets for violating his own warning when, earlier in his career, he famously conjectured about his Kuznets Curve based on a handful of very doubtful inequality observations. His 1954 Detroit AEA Presidential Address mused on how inequality might have risen and fallen over two centuries, and theorized about the sectoral and demographic shifts that might have caused such movements. Over the last half century, economists have responded enthusiastically to his postulated Kuznets Curve, searching for better data, better tests, and better models.

As we have said, Kuznets based his hypothetical Curve on very little evidence. The only country for which he had good data was the United States after 1913, on which he was the data pioneer himself. Beyond that, he judged earlier history from tax data taken from the United Kingdom since 1880 and Prussia since 1854 (1955, p. 4). For these three advanced countries, incomes had become less unequal between the late nineteenth century and the 1950s. He presented no data at all regarding earlier trends, yet bravely conjectured that "income inequality might have been widening from about 1780 to 1850 in England; from about 1840 to 1890, and particularly from 1870 on in the United States; and from the 1840's to the 1890's in Germany" (1955, p. 19). For poor, pre-industrial

[1] His Wisconsin seminar paper became a classic (Kuznets 1976).

countries, he had only household surveys for India 1949-1950, Sri Lanka 1950, and Puerto Rico 1948 (1955, p. 20). These are all bad data judged by the standards Kuznets himself applied in the 1970s. They are also bad data judged by modern World Bank standards since those three surveys from the mid-20th-century would now be given low grades on the Deininger-Squire scale assessing the quality of income distribution data (Deininger and Squire 1996, pp. 567-71). Meanwhile, world inequalities have also changed. The mid 20th century convergence of incomes within industrial countries that so impressed Kuznets has been reversed, and the gaps have widened again.

We have reason, therefore, to ask anew whether income inequality was any greater in the distant past than it is today. This paper offers five conjectures about inequality patterns during and since ancient pre-industrial times. First, income inequality must have risen as hunter-gathers slowly evolved into ancient agricultural settlements with surpluses above subsistence. Inequality rose further as economic development in these early agricultural settlements gave the elite the opportunity to harvest those rising surpluses.[2] Second, and surprisingly, the evidence suggests that the elite failed to exploit their opportunity fully since income inequality did not rise anywhere near as much as it could have. While potential inequality rose steeply over the pre-industrial long run, actual inequality rose much less. Third, in pre-industrial times, overall inequality was driven largely by the gap between the rural poor at the bottom and the landed elite at the top. The distribution of income among the elite themselves, and their share in total income, was only weakly correlated with overall inequality. Fourth, ancient pre-industrial inequality seems to have been lower in crowded East Asia than it was in the Middle East, Europe, or the world as settled by Europeans. Only in China (and Singapore) since the 1980s have East Asian national inequalities matched those of other regions. Yet, it was no higher in pre-industrial Latin America than in pre-industrial western Europe. Fifth, while there is little difference in conventionally measured inequality between modern and ancient pre-industrial societies, there are immense differences in our new, less conventional measure: the share of potential inequality actually achieved today is far less than was true of pre-industrial times.

[2] This result resembles Frederic Pryor's (1977, p. 197 and 2005, p. 40) finding that among remote foraging and agricultural communities an index of wealth inequality seems to rise with an index of "economic development." The rise in inequality seems to be tied to a rise in "centric" (regressive) taxes and tributes.

Our data are subject to all the concerns that bothered Kuznets, other economists, and the present authors. Our income inequality statistics exploit fragile measures of annual household income, without adjustment for taxes and transfers, life-cycle patterns, or household composition. None of our ancient inequality observations would rate a "1" on the Deininger-Squire scale. Yet, like Gregory King in the 1690s and Simon Kuznets in the 1950s, we must start somewhere. Section 2 begins by introducing some new concepts that we use for the analysis -- the *inequality possibility frontier* and the *inequality extraction ratio*, measures of the extent to which the elite extract the maximum feasible inequality. These new measures open the door to fresh interpretations of inequality in the very long run. Section 3 presents our ancient inequality evidence. Section 4 explores the determinants of ancient inequalities and extraction ratios. Section 5 examines income gaps between top and bottom, and the extent to which observed inequality change over the very long run is driven by those gaps as opposed to the distribution of income among those at the top or the top's income share. We conclude with a research agenda.

2. The Inequality Possibility Frontier and the Extraction Ratio

The workhorse for our empirical analysis of ancient inequalities is a concept we call the *inequality possibility frontier*. While the idea is simple enough, it has, surprisingly, been overlooked by previous scholars. Suppose that each society, including ancient non-industrial societies, has to distribute income in such a way as to guarantee subsistence minimum for its poorer classes. The remainder of the total income is the surplus that is shared among the richer classes. When average income is very low, and barely above the subsistence minimum, the surplus is small. Under those primitive conditions, the members of the upper class will be few, and the level of inequality will be quite modest. But as average income increases with economic progress, this constraint on inequality is lifted; the surplus increases, and the maximum possible inequality compatible with that new, higher, average income is greater. In other words, the maximum attainable inequality is an increasing function of mean overall income. Whether the elite fully exploit that maximum or allow some trickle-down is, of course, another matter entirely.

To fix ideas intuitively, suppose that a society consists of 100 people, 99 of whom are lower class. Assume further that the subsistence minimum is 10 units, and total income 1050 units. The 99 members of the lower class receive 990 units of income and the only member of the upper class receives 60. The Gini coefficient corresponding to such a distribution will be only 4.7 percent.[3] If total income about doubles over time to 2000 units, then the sole upper class member will be able to extract 1010 units, and the corresponding Gini coefficient will leap to 49.5. If we chart the locus of such maximum possible Ginis on the vertical axis against mean income levels on the horizontal axis, we obtain the *inequality possibility frontier* (IPF).[4] Since any progressive transfer must reduce inequality measured by the Gini coefficient, we know that a less socially segmented society would have a lower Gini.[5] Thus, IPF is indeed a *frontier*.

The *inequality possibility frontier* can be derived more formally. Define s=subsistence minimum, μ=overall mean income, N=number of people in a society, and ε=proportion of people belonging to a (very small) upper class. Then the mean income of upper class people (y_h) will be

$$y_h = \frac{\mu N - sN(1-\varepsilon)}{\varepsilon N} = \frac{1}{\varepsilon}[\mu - s(1-\varepsilon)] \qquad (1)$$

where we assume as before that the (1-ε)N people belonging to lower classes receive subsistence incomes.

Once we document population proportions and mean incomes for both classes, and assume further that all members in a given class receive the same income,[6] we can calculate any standard measure of inequality for the potential distribution. Here we shall derive the IPF using the Gini coefficient.

The Gini coefficient for *n* social classes whose mean incomes (y) are ordered in an ascending fashion ($y_j > y_i$), with subscripts denoting social classes, can be written as in equation (2)

[3] Throughout this paper, we report Ginis as percent and thus here as 4.7 rather than 0.047.
[4] The IPF concept was first introduced in Milanovic (2006).
[5] The reader can verify this by letting one subsistence worker's income rise above subsistence to 20, and by letting the richest person's income be reduced to 1000. The new Gini would be 49.49.
[6] This is already assumed for the lower classes, but that assumption will be relaxed later for the upper classes.

$$G = \sum_{i=1}^{n} G_i \, p_i \pi_i + \frac{1}{\mu} \sum_{i}^{n} \sum_{j>i}^{n} (y_j - y_i) \, p_i p_j + L \qquad (2)$$

where π_i=proportion of income received by *i*-th social class, p_i=proportion of people belonging to *i*-th social class, G_i=Gini inequality among people belonging to *i*-th social class, and L=the overlap term which is greater than 0 only if there are members of a lower social class (*i*) whose incomes exceed those of some members of a higher social class (*j*). The first term on the right-hand side of equation (2) is the within component (total inequality due to inequality within classes), the second term is the between component (total inequality due to differences in mean incomes between classes) and L is, as already explained, the overlap term.

Continuing with our illustrative case, where all members of the two social classes (upper and lower) have the mean incomes of their respective classes, equation (2) simplifies to

$$G = \frac{1}{\mu} (y_j - y_i) \, p_i \, p_j \qquad (3)$$

Substituting (1) for the income of the upper class, and *s* for the income of lower class, as well as their population shares, (3) becomes

$$G^* = \frac{1}{\mu} \left[\frac{1}{\varepsilon} \big(\mu - s(1-\varepsilon) \big) - s \right] \varepsilon (1-\varepsilon) \qquad (4)$$

where G* denotes the maximum feasible Gini coefficient for a given level of mean income (μ). Rearranging terms in (4), we simplify

$$G^* = \frac{1-\varepsilon}{\mu} \big[\big(\mu - s(1-\varepsilon) \big) - s\varepsilon \big] = \frac{1-\varepsilon}{\mu} (\mu - s) \qquad (5)$$

Finally, if we now express mean income as a multiple of the subsistence minimum, $\mu=\alpha s$ (where $\alpha \geq 1$), then (5) becomes

$$G^* = \frac{1-\varepsilon}{\alpha s} s(\alpha - 1) = \frac{\alpha - 1}{\alpha} (1-\varepsilon) \qquad (6)$$

Equation (6) represents our final expression for the maximum Gini (given α) which will chart IPF as α is allowed to increase from 1 to higher values. For example, when α=1 all individuals receive the same subsistence income and (6) reduces to 0, while when α=2, the maximum Gini becomes 0.5(1-ε). Let the percentage of population that belongs to the upper class be one-tenth of 1 percent (ε=0.001). Then for α=2, the maximum Gini will be 49.95 (once again, expressed as a percentage), we can easily see that as the percentage of people in top income class tends toward 0, G* tends toward (α-1)/α. Thus, for example, for α=2, G* would be 0.5. The hypothetical IPF curve generated for α values ranging between 1 and 5 is shown in Figure 1.

[Figure 1 about here]

The derivative of the maximum Gini with respect to mean income (given a fixed subsistence) is

$$\frac{dG^*}{d\alpha} = \frac{1-\varepsilon}{\alpha}\left(1 - \frac{\alpha - 1}{\alpha}\right) = \frac{1-\varepsilon}{\alpha^2} > 0 \qquad (7)$$

In other words, the IPF curve is increasing and concave. Using (7), one can easily calculate the elasticity of G* with respect to α as 1/(α-1). That is, the percentage change in the maximum Gini in response to a given percentage change in mean income is less at higher levels of mean income.

The *inequality possibility frontier* depends on two parameters, α and ε. In the illustrative example used here, we have assumed that ε=0.1 percent. How sensitive is our Gini maximum to this assumption? Were the membership of the upper class even more exclusive, consisting of (say) 1/50th of one percent of population, would the maximum Gini change dramatically? Taking the derivative of G* with respect to ε in equation (6), we get

$$\frac{dG^*}{d\varepsilon} = \frac{1-\alpha}{\alpha} < 0 \qquad (8)$$

Thus, as ε falls (the club gets more exclusive), G* rises. But is the response big? Given the assumption that mean income is twice subsistence and that the share of the top income class is ε=0.001, we have seen that the maximum Gini is 49.95. But if we assume instead that the top income group is cut to one-fifth of its previous size (ε=1/50 of one percent), the Gini will increase to 49.99, or hardly at all. G* is, of course, bounded by 50. For historically plausible parameters, the IPF Gini is not very sensitive to changes in the size of the top income class.

The assumption that all members of the upper class receive the same income is convenient for the derivation of the IPF, but would its relaxation make a significant difference in the calculated G*? To find out, we need to go back to the general Gini formula given in (2). The within-group Gini for the upper class will no longer be equal to 0.[7] The overall Gini will increase by $\varepsilon\pi_h G_h$ where *h* is the subscript for the upper (high) class. The income share appropriated by the upper class is

$$\pi_h = 1 - \frac{1-\varepsilon}{\alpha}$$

and the increase in the overall G* will therefore be

$$\Delta G^* = G_h\left(1 - \frac{1-\varepsilon}{\alpha}\right)\varepsilon \quad . \tag{9}$$

This increase is unlikely to be substantial. Consider again our illustrative example where α=2 and ε=0.001. The multiplication of the last two terms in (9) equals 0.0005. Even if the Gini among upper classes is increased to 50, the increase in the overall Gini (ΔG*) will be only 0.025 Gini points. We conclude that we can safely ignore the inequality among the upper class in our derivation of the maximum Gini. Moreover, note that maximum feasible inequality is derived on the assumption that the size of the elite tends towards an arbitrarily small number. That arbitrarily small number can be one, in which case, of course, inequality within the elite must be nil. This inference should not imply a disinterest in actual distribution at the top; indeed, we will assess the empirical support for it in section 5.

The inequality possibility frontier can also serve as a measure of inequality with a clear intuitive economic meaning. Normally, measures of inequality reach their extreme values when one individual appropriates the entire income (not simply all the surplus). Such extreme values are obviously just theoretical and devoid of any economic content since no society could function in such a state. That one person who appropriated the entire income would soon be all alone (everyone else having died), and after his death inequality would fall to zero and the society would cease to exist. The inequality possibility frontier avoids this irrelevance by charting maximum values of inequality compatible with the maintenance of a society (however unequal), and thus represents the maximum inequality that is sustainable in the long run. Of course, those at subsistence

[7] For the lower class, within-group inequality is zero by assumption since all of its members are taken to live at subsistence.

may revolt and overturn the elite, suggesting that the subsistence level is itself endogenous to more than just equilibrating Malthusian physiological forces.[8]

3. The Data: Social Tables and Pre-Industrial Inequality

Income distribution data based on large household surveys are almost never available for any pre-industrial society. In lieu of surveys, we derive seventeen of our 29 estimates of ancient inequalities from what are called *social tables* (or, as William Petty called them more than three centuries ago, *political arithmetick*) where various social classes are ranked from the richest to the poorest with their estimated population (family or household head) shares and average incomes.[9] Social tables are particularly useful in evaluating ancient societies where classes were clearly delineated, and the differences in mean incomes between them were substantial. Theoretically, if class alone determined one's income, and if income differences between classes were large while income differences within classes were small, then all (or almost all) inequality would be explained by the between-class inequality. One of the best social table examples is offered by Gregory King's famous estimates for England and Wales in 1688 (Barnett 1936; Lindert and Williamson 1982). King's list of classes summarized in Table 1 is fairly detailed (31 social classes). King (and others listed in Table 1) did not report inequalities within each social class, so we cannot identify within-class inequality for 1688 England and Wales.

However, within-class inequalities can be roughly gauged by calculating two Gini values: a lower bound Gini1, which estimates only the between-group inequality and assumes within-group or within-social class inequality to be zero; and a higher Gini2, which estimates the maximum inequality compatible with the social tables grouped data assuming that all individuals from a higher social group are richer than any individual from a lower social group. In other words, where class mean incomes are such that $y_j > y_i$,

[8] Note that in the special case where subsistence is zero, G* rises to the maximum value of 1 (or 100 in percentage terms). To see this, let $\alpha \to \infty$ in equation (6) (which is the case if s=0) and apply L'Hospital's rule.

[9] As far as we can determine, the compilers of the social tables did include income in kind produced by the consuming households themselves. Looking at the English source materials in particular, we find that Gregory King and others sought to know what different people consumed, and tied their income estimates to that. In addition, the tax returns they often used for their estimates seem to include assessments of owner-occupied housing.

it also holds true that $y_{kj}>y_{mi}$ for all members of group *j*, where *k* and *m* are subscripts that denote individuals. Thus, in addition to between-class inequality Gini2 includes some within-class inequality (see equation 2), but under the strong assumption that all members of a given social class are poorer or richer than those respectively above or below them.[10] (The overlap component L from equation (2) is by construction assumed to be zero.) The differences between the two Ginis are in most cases very small, as the lion's share of inequality is accounted for by the between-class component (see Table 2). This means that our Ginis will be fairly good estimates of inequality for (i) class-structured societies and (ii) societies whose social tables are fairly detailed, that is include many social classes. If (i), then the overlap should be expected to be fairly small, as (say) all members of nobility are richer than all artisans, and the latter than all farmers. Similarly, when social tables are detailed (a topic we discuss below), the definitions become fairly precise, and the overlap is less. Athe extreme, a social table such that each individual representis a "social class" would make the overlap equal to zero.

Our Gini would be downward biased in cases where social tables present only a few classes but in reality the social structure is finely gradated—in that case, both Gini1 and Gini2 would miss lots of "overlap" inequality. However, we believe that such cases are unlikely. Why? When authors of social tables created these tables, their interest was in the salient income cleavages they observed around them. If a society was strongly stratified, it seems likely that these observers would present estimated average incomes for only a few groups; if in contrast a society was less stratified, it seems likely that the observers would tend to supply estimates for many more social groups (as King and Massie did for England and Wales). Thus, the number of social groups is likely to vary across societies, and the co-existence of a finely class-gradated society with a social table containing only a few social classes is very unlikely.

For two cases (South Serbia 1455 and Levant 1596), we have used Ottoman location-specific tax surveys. These surveys allow us to estimate mean income per

[10] Gini2 is routinely calculated for contemporary income distributions when the data, typically published by countries' statistical offices, are reported as fractiles of the population and their income shares. In that case, however, any member of a richer group must have a higher income than any member of a poorer group. This is unlikely to be satisfied when the fractiles are not income classes but social classes as is the case here. The Gini2 formula is due to Kakwani (1980).

settlement. In these two cases, settlements (hamlets, villages, towns) are the units of observation and building blocks for our estimates of inequality: they play the same role played by social or professional classes in all other cases. Although these two surveys are methodologically different, the wealth of information they provide leads us to believe that their inequality estimation is of similar or equal quality as the class-based estimations.[11]

[Table 1 about here]

Table 1 lists 29 pre-industrial societies for which we have calculated inequality statistics. (Detailed explanations for each income distribution are provided in the Appendix 1.) These societies range from early first-century Rome (Augustan Principate) to India in the year of independence from Britain in 1947. Since we assume, somewhat conservatively, an annual subsistence minimum of $PPP 300,[12] and with GDI per capita ranging in our sample from about $PPP 450 to just above $PPP 2000,[13] α ranges from about 1.5 to 6.8. A GDI per capita of $PPP 2000 is a level of income not uncommon today, and it would place 1732 Holland or 1801-03 England and Wales in the 40th percentile in the world distribution of countries by per capita income in the year 2000. With the possible exception of 1732 Holland and 1801-3 England, countries in our sample have average incomes that are roughly comparable with contemporary pre-

[11] As explained above, both approaches underestimate inequality by assuming that the mean income of each group (social in one case, settlement in the other) hold for all members of that group. It could be argued that the downward bias is greater in the case of settlements (which may be economically more diverse within) than in the case of social classes (e.g., most nobles tend to be richer than most peasants). However, a very large number of settlements for which the means are available in the Ottoman surveys provides an offsetting influence to that bias: the informational content of having mean incomes for more than 1,000 settlements may be greater than having mean income estimates for half a dozen social classes.

[12] This is less than Maddison's (1998, p.12) assumed subsistence minimum of $PPP 400 which, in principle, covers more than physiological needs. Note that a purely physiological minimum "sufficient to sustain life with moderate activity and zero consumption of other goods" (Bairoch 1993, p.106) was estimated by Bairoch to be $PPP 80 at 1960 prices. Using the US consumer price index to convert Bairoch's estimate to international dollars yields $PPP 355 at 1990 prices. Our minimum is also consistent with the World Bank absolute poverty line which is 1.08 per day per capita in 1993 $PPP (Chen and Ravallion 2007, p. 6). This works out to be about $PPP 365 per annum in 1990 international prices. Since more than a billion people are calculated to have incomes less than the World Bank global poverty line, it is reasonable to assume that the physiological minimum income must be less. One may recall also that Colin Clark (1957, pp. 18-23), in his pioneering study of incomes, distinguished between international units (the early PPP dollar) and oriental units, the lower dollar equivalents which presumably hold for subtropical or tropical regions where calorie, housing and clothing needs are considerably less than those in temperate climates. Since our sample includes a fair number of tropical countries, this gives us another reason to use a conservatively low estimate of the physiological minimum.

[13] All dollar data, unless indicated otherwise, are in 1990 Geary-Khamis PPP dollars.

industrial societies that have not yet started significant and sustained industrialization. The urbanization rate in our sample ranges from 2 or 3 percent (South Serbia 1455, Java 1880) to 45 percent (Holland 1561). Population size varies even more, from an estimated 80,000 in South Serbia 1455 and 237,000 in Levant 1596 to 350 million or more in India 1947 and China 1880.

The number of social classes into which distributions are divided, and from which we calculate our Ginis, varies considerably. They number only three for 1784-99 Nueva España (comprising the territories of today's Mexico, parts of Central America, and parts of western United States) and 1880 China. In most cases, the number of social classes is in the double digits. Understandably, large numbers of groups are found in the case of occupational censuses: thus, the data from the 1872 Brazilian census include 813 occupations, and the Levantine census includes average incomes for more than 1400 settlements. The largest number of observations is provided in the famous 1427 Florentine (Tuscan) census where income data for almost 10,000 households are available. As we shall see below, these large differences in the number of groups have little effect on the measured Gini1 and Gini2 values.

The estimated inequality statistics are reported in Table 2. The calculated Gini2's display a very wide range: from 24.5 in China 1880 to 63.5 in Nueva España 1784-99 and 63.7 in Chile 1861.[14] The latter figure is higher than the inequality reported for some of today's most unequal countries like Brazil and South Africa. The average Gini2 from these 29 data points is 44.3, while the average Gini from the modern counterpart countries is 40.6[15] These are only samples, of course, but there is very little difference on average between them, 44.3(ancient) – 40.6(modern counterparts) = 3.7.[16] In contrast, there are very great differences within each sample: 58.8 (Brazil 2002) – 26.0 (Japan 2002) = 32.8 among the modern counterparts, while 63.5 (Nueva España 1784-99) - 24.5 (China 1880) = 39 among the ancient economies. In short, inequality differences within

[14] South Serbia 1455 Gini is even lower (20.9) but the survey excludes Ottoman landlords. We shall make adjustment for such omission in the empirical analysis below.
[15] The modern counterpart countries are defined as countries that currently cover approximately the same territory as the ancient countries (e.g., Turkey for Byzantium, Italy for Rome, Mexico for Nueva España, modern Japan for ancient Japan, and so on).
[16] The hypothesis of equality of the two means is easily accepted (*t* test significant at 22 percent only).

the ancient and modern samples are many times greater than are differences between their averages.

The Gini estimates are plotted in Figure 2 against the estimates of GDI per capita on the horizontal axis. They are also displayed against the *inequality possibility frontier* constructed on the assumption of a subsistence minimum of $PPP 300 (solid line). In most cases, the calculated Ginis lie fairly close to the IPF. In terms of absolute distance, the countries farthest below the IPF curve are the most “modern” pre-industrial economies: 1561-1808 Holland and the Netherlands, 1788 France, and 1688-1801 England and Wales.

How do country inequality measures compare with the maximum feasible Ginis at their estimated income levels? Call the ratio between the actual inequality (measured by Gini2) and the maximum feasible inequality the *inequality extraction ratio*, indicating how much of the maximum inequality was actually extracted: the higher the *inequality extraction ratio*, the more (relatively) unequal the society.[17] The median and mean inequality extraction ratios in our ancient sample are 74.2 and 74.9 percent, respectively. Thus, almost three-quarters of maximum feasible inequality was actually “extracted” by the elites in our pre-industrial sample. To put a more positive spin on it, the elites did not want, or were unable, to extract the last one-quarter of maximum feasible inequality. The countries with the lowest ratios are 1924 Java and 1811 Kingdom of Naples with extraction ratios of 48 and 54 percent, respectively. In these cases, the elite left about half of the maximum feasible inequality on the table for the non-elite.

Three estimated Ginis are equal to or slightly greater than the maximum Gini implied by the IPF (given level of income): Moghul India 1750 (an extraction ratio of 113 percent), Nueva España 1790 (an extraction ratio of 106 percent) and Kenya in 1927 (an extraction ratio of 100 percent). Recalling our definition of the IPF, these cases can only be explained by one or more of the following four possibilities: inequality within the rich classes is very large; the subsistence minimum is overestimated; the inequality estimate is too high; and/or a portion of the population cannot even afford the subsistence

[17] The term “relative” is used here, *faute de mieux*, to denote conventionally calculated inequality in relation to maximum possible inequality at a given level of income, not whether the measure of inequality itself is relative or absolute.

minimum. We have already analyzed and dismissed the first two possibilities. The third possibility is unlikely; as our estimates of inequality are calculated from a limited number of social classes, they are likely to be biased downwards, not upwards. The last possibility offers the most plausible explanation. In the case of Moghul India and Nueva España, a portion of the population might have been expected to die from hunger or lack of elementary shelter. But poor people's income often does, in any given month, or even year, fall below the minimum and they survive by borrowing or selling their assets. Still, the same individuals cannot, by definition, stay below subsistence for long. Such societies were not viable since the population could not be sustained. The fact that the only two such societies in our sample, 1750 Moghul India and 1790 Nueva España, were both notoriously exploitative seems to support the fourth explanation.

The observations for England and Wales, and Holland/Netherlands -- the only countries for which we have at least three pre-industrial observations -- are connected to highlight their historical evolution of inequality relative to the IPF. Between 1290 and 1688, and particularly between 1688 and 1759, the slope of the increase of the Gini in England and Wales was significantly less than the slope of the IPF. Thus, the English extraction ratio dropped from about 69 percent in 1290, to 57 percent in 1688 and to about 55 percent in 1759. However, between 1759 and 1801, the opposite happened: the extraction ratio rose to almost 61 percent. Or consider Holland/Netherlands between 1732 and 1808. As average income decreased (due to the Napoleonic wars), so too did inequality, but the latter even more so. Thus, the extraction ratio decreased from around 72 to 68 percent.

[Table 2 and Figure 2 about here]

The *inequality possibility frontier* allows us to better situate these ancient inequality estimates in the modern experience. Using the same framework that we have just applied to ancient societies, the bottom panel of Table 2 provides estimates of inequality extraction ratios for some 25 contemporary societies. Brazil and South Africa have often been cited as examples of extremely unequal societies, both driven by long experience with racial discrimination, tribal power and regional dualism. Indeed, both countries display Ginis comparable to those of the most unequal pre-industrial societies. But Brazil and South Africa are several times richer than the richest ancient society in our sample, so that the maximum feasible inequality is much higher than anything we have seen in our ancient sample. Thus, the elites in both countries have extracted only a little more than 60 percent of their maximum feasible inequality, and their inequality extraction ratios are about the same as what we found among the *less* exploitative ancient societies (1801-3 England and Wales, and 1886 Japan).

In the year 2000, countries near the world median GDI per capita (about $PPP 3500) or near the world mean population-weighted GDI per capita (a little over $PPP 6000), had maximum feasible Ginis of 91 and 95 respectively. The median Gini in today's world is about 35, a "representative" country having thus extracted just a bit less than 40 percent of feasible inequality, vastly less than did ancient societies. For the modern counterparts of our ancient societies, the ratio is just under 44 percent (Table 2). China's present *inequality extraction ratio* is almost 46 percent, while that for the United States is almost 40 percent, and that for Sweden almost 28 percent. Only in the extremely poor countries today, with GDI per capita less than $PPP 600, do actual and maximum feasible Ginis lie close together (2004 Congo D. R., and 2000 Tanzania).[18] Compared with the maximum inequality possible, today's inequality is *much* smaller than that of ancient societies.

It could be argued that our new *inequality extraction ratio* measure reflects societal inequality, and the role it plays, more accurately than any actual inequality measure. For example, Tanzania (denoted TZA in Figure 3) with a relatively low Gini of about 35 may be less egalitarian than it appears since measured inequality lies fairly close to its *inequality possibility frontier* (Table 2 and Figure 3). On the other hand, with a much higher Gini of almost 48, Malaysia (MYS) has extracted only about one-half of maximum inequality, and thus is farther away from the IPF. This new view of inequality may be more pertinent for the analysis of power and conflict in both ancient and modern societies.

[Figure 3 about here]

[18] Actually, the extraction ratio for Congo is in excess of 100 percent. It is very likely that Congo's real income ($PPP 450 per capita) is underestimated. But even so, the extraction ratio would be close to 100 percent.

Another implication of our approach is that it considers inequality and development jointly. As a country becomes richer, its feasible inequality expands. Consequently, even if recorded inequality is stable, the *inequality extraction ratio* must fall; and even if recorded inequality goes up, the extraction ratio may not. This can be seen in Figure 4 where we plot the inequality extraction ratio against GDI per capita for both ancient societies and their modern counterparts. The farther a society rises above the subsistence minimum, the less will economic development lift its *inequality possibility frontier*, and thus the *inequality extraction ratio* will be driven more and more by the rise in the Gini itself. This is best illustrated by the United States where the maximum feasible inequality already stands at a Gini of 98.6. Economic development offers this positive message: the *inequality extraction ratio* will fall with GDI per capita growth even if measured inequality remains constant. However, economic decline offers the opposite message: that is, a decline in GDI per capita, like that registered by Russia in the early stages of its transition from communism, drives the country's maximum feasible inequality down. If the measured Gini had been stable, the *inequality extraction ratio* would have risen. If the measured Gini rose (as was indeed the case in Russia), the *inequality extraction ratio* would have risen even more sharply. Rising inequality may be particularly socially disruptive under these conditions.

[Figure 4 about here]

4. Explaining Pre-Industrial Inequality and the Extraction Ratio

Using this information from ancient societies, can we explain differences in observed inequality and the extraction ratio? We have available, of course, the Kuznets hypothesis whereby inequality tends to follow an inverted U as average real income increases. Although Kuznets formulated his hypothesis explicitly with a view toward the industrializing economies (that is, with regard to economies that lie *outside* our sample), one might wonder whether the Kuznets Curve can be found among pre-industrial economies as well. In addition to average income and its square, Table 3 includes the urbanization rate, population density and colonial status (a dummy variable). The regression also includes a number of controls for country-specific eccentricities in the data: the number of social groups available for calculating the Gini, whether the social table is based on tax data, and whether the social table for a colony includes income for the colonizers. The Kuznets hypothesis predicts a positive coefficient on average income and negative coefficient on its square. We also expect higher inequality for the more urbanized countries (reflecting a common finding that inequality in urban areas tends to be higher than in rural areas: Ravallion et al. 2007), and for those that are ruled by foreign elites since powerful foreign elites are presumed able to achieve higher extraction ratios than weaker local elites, and since countries with weak local elites but large surpluses to extract will attract powerful colonizers (Acemoglu, Johnson and Robinson 2001).

The regression results readily confirm all expectations. Both income terms are of the right sign, and significant at less than 1 percent levels, strongly supporting a (conditional) pre-industrial Kuznets Curve. The sign on urbanization is, as predicted, positive, but since it competes with population density, its significance is somewhat lower. Still, each percentage point increase in the urbanization rate (say, from 10 percent to 11 percent) is associated with an increase in the Gini by 0.35 points. Colonies are clearly much more unequal: holding everything else constant, a colony would have a Gini about 12-13 points higher than a non-colony. *Dno_foreign* is a dummy variable that controls for two observations (South Serbia 1455 and Levant 1596) that were colonies but where their ancient inequality surveys did not include the incomes and numbers of colonizers at the top. This is therefore simply another control for data eccentricity, and its negative sign shows that being a colony, and not having colonizers included in the survey, reduces recorded inequality considerably (almost 10 points) compared to what one might expect.[19] In summary, being a colony was a major determinant of measured inequality. Excluding South Serbia 1455 and Levant 1596, the measured Gini2 ranges between 24.5 for China 1880 and 63.7 for Chile 1861 (Table 2), that is, the spread is 39.2 percentage points, and the colony effect is 13.6/39.2=35 percent of that spread, a big influence indeed.

The number of social groups that we use in our inequality calculations does not seem to affect the Gini values. In the regression analysis of the extraction ratio, we shall

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[19] If colonies with no information on colonizers were a random draw from all the statistical population of all colonies (which of course they are not), we would expect the two coefficients to be the same but, of course, of opposite sign.

experiment with different upward-adjusted values of the Gini (and hence higher values of the extraction ratio) to find out if our results are sensitive to the way Ginis were calculated, and, in particular, to the difference in the number of social groups used in the calculation.

[Table 3 about here]

Population density is negatively associated with inequality (in all formulations, including those not shown here) and is significant. According to regression 1 (Table 3), an increase in population density by 10 persons per square kilometer (equivalent to an increase in population density from that of the early nineteenth century Naples to England and Wales) is associated with a 1 Gini point decrease. One might have thought that the introduction of a dummy variable for more densely populated Asian countries would have caused the effect of density to dissipate. This is not the case, as shown by regression 2 (Table 3).[20] Thus, inequality is associated with lower population density and lower labor-land ratios, at least in our sample. If this effect holds for larger samples, what might explain it? Conventional economics gave us a strong prior which has been rejected: higher labor-land ratios in agrarian systems imply higher rents per hectare and lower labor productivity, and thus more inequality. Although we cannot explore competing explanations for this density result with our ancient inequality evidence, we can list some likely candidates. Here are two, with opposite causal chains. First, where land was scarce, land intensive products, like food grains, should have been expensive, especially in ancient times when there was no global grain market. Expensive grains implied the necessity of more nominal income to purchase a subsistence quantity of foodstuffs, and thus the appearance of lower measured inequality (and extraction ratios). Second, less

[20] True, when we eliminate the two Java observations, a region with the highest population density in our sample and with relatively low inequality, the negative coefficient on population density begins to lose its statistical significance at conventional levels (although barely so, since it is still significant at 5.3 percent).

exploitative societies, which arose for reasons we do not know, might have allowed higher subsistence (lower inequality and extraction ratios), bigger survival rates, larger populations, and thus greater density.

When exploring the determinants of the extraction ratio, theory is less helpful. A simple plot of the extraction ratio against ln GDI per capita displays a negative and statistically significant relationship (see Figure 5). In regression 4 (Table 3), the extraction ratio is regressed against much the same variables as with the Gini.[21] Income is negatively (and significantly) associated with the extraction ratio,[22] while being a colony and being more urbanized are both associated with higher extraction ratios. Having a colonial elite—with everything else the same—is associated with a very large 16.2 point increase in the extraction ratio. The introduction of population density (regression 5, Table 3) renders both income and urbanization rate statistically insignificant. The positive effect of being a colony remains and the coefficient even increases (to 25 extraction ratio points). Similar to the inequality result, greater population density is strongly associated with lower extraction ratios. The result persists even after we eliminate observations for Java (regression 6), although only at the 5 percent significance level. Figure 6 plots population density against the residuals from regression 6 (which omits the two observations from Java: see footnote 20). As can be seen, the relationship is still strongly negative.

[Figures 5 and 6 about here]

To explore the sensitivity of these results to the issue of measurement, we introduce three additional computations of the Gini. First, we use Deltas' (2003) correction whereby the measured Gini is adjusted by the n/n-1 ratio, where n is the number of social groups. [23] Second, we use information from the bootstrapped standard errors of the Gini. As expected, standard errors are generally greater the fewer the

[21] We no longer include survey controls (number of groups or a dummy for tax-based source) since we have seen that they do not make a difference in the calculations of the Gini.
[22] Including income squared reveals no significant curvature (results not shown here).
[23] Deltas adjustment for small-sample Ginis is derived for the "usual" case where Gini is estimated from the ordered fractile data (and where the overlap component between the fractiles is, by construction, zero). We apply it here in a somewhat different context (where incomes of various social groups may overlap).

number of social groups.[24] We thus adjust our measured Ginis by adding, in one case, ½ of standard error, and in the other case, one standard error.[25] The regressions (reported in Appendix 4) show that all the main results carry over. The only notable change is that the coefficient on population density, in a formulation that omits the two observations from Java, is significant only around the 10 percent level. Simultaneously, the role of higher income in reducing the extraction ratio, particularly when Gini is revised upward a lot (measured Gini + one standard error), becomes stronger. We conclude that the population density results are not fully robust to some alternative upward Gini adjustments *combined* with the elimination of the two extreme population density observations.

When we draw together the analyses of inequality and the extraction ratio, the picture that emerges is this: the Gini follows contours that are broadly consistent with the Kuznets Curve hypothesis (a rise and then a turn-around to falling inequality) even in pre-industrial societies, but the extraction ratio tends to fall as income increases, with no turn-around. In other words, while inequality at first increases as income per capita rises, it does not increase to the full extent made possible by the larger surplus, so that the extraction ratio falls. In addition, higher population density puts downward pressure both on the Gini and the extraction ratio. Its effect is particularly strong in the latter case so that both income and urbanization become insignificant. Finally, colonies record very high inequality and extraction ratios throughout.[26]

The data also shed light on the historical persistence of inequality. First, it does not appear that ancient Asia was significantly less unequal when we control for other factors, such as population density. When the Asian dummy is added to regression 2, its coefficient is negative, but it is not significant. That is, population density may be sufficient to identify why ancient Asia had lower levels of inequality. Some have argued this result is driven by the absence of scale economies in rice cultivation (Jones 1981; Bray 1986), but we have already offered other possibilities as well.

[24] The correlation coefficient is -0.46.

[25] Because our measured Ginis do not include the "overlap" component, they underestimate "true" Ginis.

[26] With one exception, the data sources use the gross national income accounting convention, which measures global incomes for residents of a place. Thus the estimates include as "Indian" those British citizens resident in India, whereas those resident in Britain getting incomes from India are included in the British income distribution. The one exception is the estimate for the Roman Empire, which unavoidably aggregates the colonizing and colonized populations together (and for many reasons, Roman Empire may be considered a single political entity).

Second, Stanley Engerman and Kenneth Sokoloff (1997, 2000) have offered a hypothesis to account for Latin American growth underachievement during the two centuries following its independence which appeals to the region's persistent inequality since 1492. Their thesis begins with the plausible assertion that high levels of income inequality, and thus of political power, favor rich landlords and rent-seekers, and thus the development of institutions which are compatible with the former but incompatible with economic growth. Their thesis argues further that high levels of Latin American inequality have their roots in the natural resource endowments present after Iberian colonization five centuries ago. Exploitation of the native population and African slaves, as well as their disenfranchisement, reinforced the development of institutions incompatible with growth. Engerman and Sokoloff had no difficulty collecting evidence which confirmed high inequality, disenfranchisement and lack of suffrage in Latin America compared with the United States. Oddly enough, however, their thesis has never been confronted with inequality evidence for the industrial leaders in northwestern Europe. It would be damaged if we can show that inequality in England, Holland and France, prior to their industrial revolutions, was greater than or equal to that of Latin America, while during and after their industrial revolutions the former three led the world economically and the latter lagged behind (e.g. Maddison 2003, Prados de la Escosura 2004).

Table 2 presents inequality information for pre-industrial Western Europe (that is, prior to 1810) and for pre-industrial Latin America (that is, prior to 1875). For the former, we have observations from 1788 France, 1561 and 1732 Holland, and 1688, 1759 and 1801 England-Wales. For the latter, we have Nueva España 1790, Chile 1861, Brazil 1872 and Peru 1876. Engerman and Sokoloff coined their hypothesis in terms of actual inequality. According to that criterion, their thesis must be rejected. That is, the (population weighted) average Latin American Gini (48.9) was *lower* than that of western Europe (52.9), not higher.[27] True, the variance in the Gini is considerable within both regions, but it is not true that pre-industrial Latin America was unambiguously more unequal than pre-industrial western Europe. However, Latin America was poorer than western Europe, and poorer societies have a smaller surplus for the elite to extract. Thus,

[27] The same is true of the unweighted average.

feasible inequality was lower in Latin America (range of 59.9-62.4 versus European range of 77.7-79.8). As it turns out, *extraction rates* were considerably higher in Latin America than in western Europe. Thus, while measured inequality does not support the Engerman-Sokoloff thesis, the extraction rate does. This suggests a new question to be added to the long run growth debate: Why was the *extraction rate* so much higher in Latin America? Was it simply because they were colonized?

5. What Components Are Driving Overall Income Distribution?

How much of the inequality observed in ancient societies can be explained by the economic distance between the average rural landless peasant at the bottom and the average rich landed elite at the top? How much can be explained by the distribution among the elite at the top? And how much can be explained by the income share held by all the elite at the top?

Life at the Top: Income Distribution Involving the Elite

An impressive amount of recent empirical work has suggested that the evolution of the share of the top 1 percent yields a good approximation to changes in the overall income distribution in modern industrial societies (Piketty 2003, 2005; Piketty and Saez 2003, 2006; Atkinson and Piketty forthcoming). These studies find that most of the action takes place at the top of the income distribution pyramid and that changes or differences in the top 1 percent income share account for much of the changes or differences in overall inequality (Leigh 2007). These top share studies have also been performed on poor pre-modern India (since 1922: Banerjee and Piketty 2005), Indonesia (since 1920: Leigh and van der Eng 2006) and Japan (since 1885: Moriguchi and Saez 2005). So, are differences in the share of the top 1 percent also a good proxy for differences in overall income distribution in ancient pre-industrial societies?

The income share of the top 1 percent is estimated here under the assumption that top incomes follow a Pareto distribution. Our approach is basically the same as that recently used by Anthony Atkinson (forthcoming) and by others writing before him (see the references in Atkinson forthcoming).[28]

Table 4 reports the estimated income share of the top 1 percent of recipients, and the cut-off point, that is the income level (relative to the mean) where the top one percent of recipients begins. The countries are listed in descending order according to the top 1 percent share. In contrast with modern studies, the correlation between the top 1 percent share and the Gini is small (+0.18) and statistically insignificant.[29] This implies that differences in overall inequality are not reflected by differences in the top percentile share very well. Consider, for example, the Roman and Byzantine empires. Their estimated Ginis are very similar (39.4 and 41.1) but the top percentile share in Byzantium (30.6, the highest in our sample) is almost twice as great as in Rome (16.1).

[Table 4 about here]

The poor correlation between the top 1 percent and overall inequality in the ancient pre-industrial sample is also supported by more evidence. Table 4 also reports modern counterparts to our ancient economies as well as a few other modern countries. Among the modern counterparts, those with the highest top 1 percent share (Mexico, Brazil) display values that are equal to the average for the ancient economies (about 14 percent of total income). Relatively low top 1 percent shares (from the UK at 7 percent to the Netherlands at 3.6 percent) plus low cut-off points (characteristic of advanced societies) announces modern distributions where the richest 1 percent are not extravagantly rich nor extremely different from the population average.[30] We have already noted that Gini coefficients in ancient and contemporary poor societies are quite similar, so the difference in the average top 1 percent shares between ancient and modern societies implies further support for the view that the link between top income shares and overall inequality is very weak between ancient and modern societies.

[28] The estimation procedure is explained in detail in Appendix 3. There we list several caveats necessitated by the fact that our social tables are different from the usual income distribution data sources.

[29] The correlation between the top 1% share and Gini coefficient among the modern comparators given in Table 4 is +0.97 (and statistically significant at less than 0.1 percent).

[30] The data for modern societies are calculated from household surveys that are, we believe, closer counterparts to our social tables than the top income shares calculated from tax data. The latter almost uniformly give higher values: for the developed countries, they range from about 5 to almost 15 percent of *gross* (pre-tax) income. We present these data for completeness in Table 4.

Life at the Bottom: The Unskilled Rural Wage Relative to Average Income

For fourteen of the 29 observations in our ancient inequality sample, we can measure the economic distance between the middle of the distribution and landless labor by computing the ratio of average income per recipient (y) to that of landless, unskilled rural laborer (w). Figure 7 plots the relation between the overall Gini and the y/w ratio.[31] The correlation between y/w and the Gini is positive and significant (0.52). The estimated relationship also implies an elasticity of the Gini with respect to y/w of 0.35: thus, for every 10 percent increase in y/w, the Gini rose by 3.5 percentage points. Low measured inequalities in China 1880 and Naples 1811 (Ginis of 24.2 and 28.4: Appendix 2) were consistent with small gaps between poor rural laborers and average incomes (y/w of 1.32 and 1.49: Appendix 2), or with a rural wage two-thirds to three-quarters of average income. High measured inequalities in Nueva España 1784-99 and England 1801-03 (Ginis of 63.5 and 51.4) were consistent with large gaps between poor rural laborers and average incomes (y/w of 4.17 and 2.94), or with a rural wage only one-quarter to one-third of average income. There appears to be only one possible outlier to the otherwise tight relationship in Figure 7, British India in 1947. The overall relationship suggests that the Gini correlates more closely with the gap between poor landless labor and the landed elite, than with the top 1 percent share: to repeat, Gini has a significant correlation with y/w, but an insignificant 0.02 correlation with the share received by the top 1 percent.[32]

[Figure 7 about here]

6. New Inequality Insights and an Agenda for the Future

Our exploration of ancient pre-industrial experience has uncovered three key aspects of inequality which had not been appreciated before.

First, income inequality in pre-industrial countries today is not very different from inequality in distant pre-industrial times.[33] In addition, the variance of inequality among

[31] See also Appendix 2. This simple y/w index has been shown to be a good proxy for inequality among nineteenth and twentieth century poor economies (Williamson 1997, 2002).

[32] This 0.02 correlation refers to the 26 cases in Table 4. When we reduce the sample to the same 14 cases used for y/w, the correlation between the top 1 percent share and the overall Gini becomes negative 0.21.

[33] However, it seems likely that any measure of lifetime income (as opposed to annual income used here) inequality would confirm that ancient pre-industrial inequality was higher than modern pre-industrial inequality. After all, there has been an immense convergence in mortality and morbidity by social class in

countries then and now is much greater than any difference in average inequality between them then and now.

Second, the *extraction ratio* – how much of potential inequality was converted into actual inequality – was significantly bigger then than now. We are persuaded that much more can be learned about inequality in the past *and* the present by looking at the *extraction ratio* rather than just at actual inequality. The ratio measures just how powerful, repressive and extractive are the elite, its institutions, and its policies. Regression analysis suggests that colonies are much more unequal and have far higher extraction rates. In addition, ancient pre-industrial societies passed through a Kuznets Curve, inequality rising steeply until the beginning of modern economic growth. Economic development also tends to diminish the extraction ratio. This latter finding suggests that even in pre-industrial societies the elite do not fully exploit their opportunity to capture more of the rising surplus as average incomes increase. While we do not explore them here, there must be factors that kept the extraction ratio from increasing, or actually lowered it, long before the appearance in the twentieth century of universal suffrage and the rise of the welfare state. Once the analysis control for these and other factors, there is no evidence left to support the view that high inequality has always been a special characteristic of Latin America, or that low inequality has always been a characteristic of Asia. Finally, greater population density is correlated with lower inequality.

Third, our ancient pre-industrial inequality sample does not reveal any significant correlation between the income share of the top 1 percent and overall inequality, unlike recent twentieth century findings for industrial and post-industrial societies. Pre-industrial societies could and did achieve high inequality in two ways: in some, a high income share of the elite coexisted with a yawning income gap between it and the rest of society, with small income differences among the non-elite; in others, those at the very top of the income pyramid were followed below by only slightly less rich and then further down the line toward something that resembled a middle class. Why were some ancient societies more hierarchal while others more socially diverse? While this paper has explored

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even poor countries since the First Industrial Revolution in Britain, and most of this was induced by elite policy towards cleaner cities and public health. See Milanovic, Lindert and Williamson (2007, section 6).

inequality over two millennia, it has not explored the social structure underpinning that inequality, its determinants, and its impact. We plan to pursue this issue in future work.

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Table 1

Data Sources, Estimated Demographic Indicators and GDI Per Capita

Country/territory	Source of data	Year	Number of classes	Estimated urbanization rate (in %)	Population (in 000)	Area (in km^2)	Population density (person/km^2)	Estimated GDI per capita
Roman Empire	Social tables	14	11	10	55000	3,300,000	16.7	633
Byzantium	Social tables	1000	8	10	15000	1,250,000	12.0	533
England and Wales	Social tables	1290	7	14.5	4300	130,000	33.1	639
Tuscany	Professional census	1427	9780					978
South Serbia	Settlement census	1455	615	2	80	6,344	12.6	443
Holland	Tax census dwelling rents	1561	10	45	983	21,680	45.3	1129
Levant	Settlement census	1596	1415	11	263	26,250	10.0	974
England and Wales	Social tables	1688	31	13	5700	130,000	44.0	1418
Holland	Tax census dwelling rents	1732	10	39	2023	21,680	93.3	2035
Moghul India	Social tables	1750	4	11	182000	3,870,000	47.0	530
England and Wales	Social tables	1759	56	16	6463	130,000	49.7	1759
Old Castille	Income census	1752	33	10	1980	89,061	22.2	745
France	Social tables	1788	8	12	27970	550,100	50.8	1135
Nueva España	Social tables	1790*	3	9.1	4500	1,224,433	3.7	755
England and Wales	Social tables	1801-3	44	30	9277	130,000	71.4	2006
Bihar (India)	Monthly census of expenditures	1807	10	10.5	3362	108,155	31.1	533
Netherlands	Tax census of dwelling rents	1808	20	36.9	2100	41,865	50.2	1800
Kingdom of Naples	Tax census	1811	12	15	5000	82,000	61.0	752
Chile	Professional census	1861	32	29	1702	756,950	2.2	1295
Brazil	Professional	1872	813	16.2	10167	8,456,510	1.2	721

Country/territory	Source of data	Year	Number of classes	Estimated urbanization rate (in %)	Population (in 000)	Area (in km^2)	Population density ($person/km^2$)	Estimated GDI per capita
	census							
Peru	Social tables	1876	15	15	2469	1,285,000	1.9	653
China	Social tables	1880	3	7	377500	9,327,420	40.5	540
Java	Social tables	1880	32	3	20020	126,700	158.0	661
Japan	Tax records	1886		15	38622	377,835	102.2	916
Kenya	Social tables	1914	13	3.9	3816	582,600	6.5	456
Java	Social tables	1924	14	3	35170	126,700	277.6	909
Kenya	Social tables	1927	13	4.3	3922	582,600	6.7	558
Siam	Social tables	1929	21	10	11605	514,000	22.6	793
British India	Social tables	1947	8	16.5	346000	3,870,000	89.4	617

Note: GDI per capita is expressed in 1990 Geary-Khamis PPP dollars (equivalent to those used by Maddison 2003 and 2004). Population density is people per square kilometer. For the data sources and detailed explanations, see Appendix 1. Observations ranked by year.
* 1790 = 1784-1799.

Table 2

Inequality Measures

country/territory, year	Gini1	Gini2	Top income class (in % of total population)	Mean income in terms of *s* (s=$300)	Maximum feasible Gini (IPF)	Inequality extraction ratio (in %)*
Roman Empire 14	36.4	39.4	0.004	2.1	52.6	75.0
Byzantium 1000	41.0	41.1	0.5	1.8	43.7	94.1
England & Wales 1290	35.3	36.7	2.3	2.1	53.0	69.2
Tuscany 1427		46.1	1	3.3	69.3	66.6
South Serbia 1455	19.1	20.9	1	1.5	32.2	64.8
Holland 1561		56.0	1	3.8	73.4	76.3
Levant 1596		39.8	1	3.2	69.1	57.6
England & Wales 1688	44.9	45.0	0.14	4.7	78.8	57.1
Holland 1732	61.0	61.1	1	6.8	85.2	71.7
Moghul India 1750	38.5	48.9	1	1.8	43.4	112.8
Old Castille 1752	52.3	52.5	0.08	2.5	59.7	88.0
Eng1and & Wales 1759	45.9	45.9	0.006	5.9	82.9	55.4
France 1788	54.6	55.9	9.7	3.8	73.5	76.1
Nueva España 1790		63.5	10	2.5	60.2	105.5
England & Wales 1801	51.2	51.5	0.08	6.7	85.0	60.6
Bihar (India) 1807	32.8	33.5	10	1.8	43.7	76.7
Netherlands 1808	56.3	57.0	0.03	6.0	83.3	68.5
Naples 1811	28.1	28.4	0.7	2.2	52.9	53.7
Chile1861	63.6	63.7	0.08	4.3	76.8	83.0
Brazil 1872	38.7	43.3	1	2.4	58.3	74.2
Peru 1876	41.3	42.2	1.04	2.2	54.0	78.1
Java 1880	38.9	39.7	0.0004	2.2	54.6	72.8
China 1880	23.9	24.5	0.3	1.8	44.4	55.2
Japan 1886		39.5		3.1	67.2	58.8
Kenya 1914	33.1	33.2	0.04	1.5	34.2	96.8
Java 1924	31.8	32.1	0.18	3.0	66.9	48.0
Kenya 1927	41.6	46.2	0.10	1.9	46.2	100.0
Siam 1929	48.4	48.5	0.87	2.6	62.1	78.1
British India 1947	48.0	49.7	0.06	2.1	51.3	96.8
Average	*41.9*	*44.3*		*3.1*	*60.6*	*74.9*
Modern counterparts						
Italy 2000		35.9		62.5	98.3	36.5
Turkey 2003		43.6		22.0	95.4	45.7
United Kingdom 1999		37.4		66.1	98.4	38.0
Serbia 2003		32.2		11.2	91.0	35.4
Netherlands 1999		28.1		72.0	98.5	28.5
India 2004		32.6		6.4	84.2	38.7
Spain 2000		33.0		50.9	97.9	33.7
France 2000		31.2		69.4	98.4	31.7
Mexico 2000		53.8		24.1	95.7	56.2
Chile 2003		54.6		33.7	96.6	56.4
Brazil 2002		58.8		13.9	92.7	63.4
Peru 2002		52.0		12.3	91.8	56.7
Kenya 1998		44.4		4.5	77.6	57.2
Indonesia 2002		34.3		10.7	90.5	37.9
China 2001		41.6		11.5	91.2	45.6

country/territory, year	Gini1	Gini2	Top income class (in % of total population)	Mean income in terms of *s* (s=$300)	Maximum feasible Gini (IPF)	Inequality extraction ratio (in %)*
Japan 2002		26.0		70.2	98.5	26.4
Thailand 2002		50.9		21.3	95.2	53.5
Average		*40.6*		*33.1*	*93.6*	*43.6*
Other contemporary countries						
South Africa 2000		57.3		14.7	93.1	61.6
United States 2000		39.9		77.7	98.6	40.5
Sweden 2000		27.3		52.2	98.0	27.9
Germany 2000		30.3		62.0	98.3	30.8
Nigeria 2003		42.1		3.0	66.7	63.1
Congo, D.R., 2004		41.0		1.5	33.3	123.1
Tanzania 2000		34.6		1.8	44.4	77.9
Malaysia 2001		47.9		26.0	96.1	49.9

* Calculated using Gini2. Modern Ginis (except for Japan and China) calculated from individual-level data from national household surveys; obtained from Luxembourg Income Survey and World Income Distribution (WYD) database; benchmark year 2002 (see http://econ.worldbank.org/projects/inequality). Ginis for Japan and China calculated from published grouped data. **Source:** For ancient societies, see Appendix 1. Ancient societies ranked by year.

Table 3 Regression Results for Gini Coefficient and Inequality Extraction Ratio

	Gini coefficient			Inequality extraction ratio		
	1	2	3	4	5	6
GDI per capita	360.5*** (0.001)	366.7*** (0.001)	360.2*** (0.002)	-20.92** (0.022)	-6.48 (0.36)	-6.45 (0.39)
GDI per capita squared	-25.0*** (0.002)	-25.5*** (0.002)	-25.0*** (0.003)			
Urbanization rate (in %)	0.349* (0.08)	0.354* (0.08)	0.353* (0.093)	0.677* (0.07)	0.229 (0.42)	0.236 (0.43)
Population density	-0.105*** (0.001)	-0.100*** (0.003)	-0.107* (0.053)		-0.188*** (0.000)	-0.200** (0.025)
Colony (0-1)	12.63*** (0.001)	12.93*** (0.001)	12.41*** (0.002)	16.12** (0.027)	25.52*** (0.000)	25.35*** (0.000)
Dno_foreign (0-1)	-9.59 (0.25)	-9.97 (0.25)	-9.26 (0.29)	-25.28** (0.03)	-39.20*** (0.000)	-39.23*** (0.000)
Asia (0-1)		-1.28 (0.69)				
Number of groups	-0.009 (0.16)	-0.009 (0.19)	-0.010 (0.18)			
Tax survey (0-1)	-4.86 (0.57)	-4.85 (0.24)	-4.85 (0.28)			
Constant	-1246*** (0.001)	-1266*** (0.001)	-1245*** (0.002)	201.6*** (0.001)	117.6** (0.013)	117.6** (0.018)
No of obs	28	28	26	28	28	26
Adjusted R^2	0.75	0.73	0.73	0.34	0.65	0.60

Note: Both GDI per capita are in natural logs. Coefficients significant at 10, 5 and 1 percent level denoted by respectively one, two and three asterisks. *p* values between brackets. Population density = number of people per square kilometer.

Table 4. Estimated Top of the Income Distribution

	Top 1% share in total income (in %)	The cut-off point (in terms of mean income)	Gini coefficient
Kenya 1927	31.7	20.9	46.2
Byzantium 1000	30.6	3.7	41.1
Chile 1861	25.7	11.8	63.7
Kenya 1914	23.2	20.5	33.1
China 1880	21.3	5.6	24.5
Nueva España 1790	21.1	9.8	63.5
Peru 1876	20.8	9.6	42.2
Japan 1886	19.1	n.a.	39.5
Netherlands 1808	17.1	9.8	57.0
France 1788	16.8	6.9	55.9
Rome 14	16.1	12.4	39.4
India-Moghul 1750	15.0	15.0	48.9
K. of Naples 18	14.3	5.5	28.4
India British 1947	14.0	16.9	49.7
Holland 1753	13.7	9.1	61.1
Tuscany 1427	13.0	7.2	46.1
England 1290	12.2	6.1	36.7
Bihar 1807	11.5	3.8	33.5
Java 1880	11.4	3.9	39.7
Java 1924	11.4	4.1	32.1
Brazil 1872	11.2	5.7	43.3
England 1759	10.9	4.2	45.9
England 1801	8.9	6.2	51.5
England 1688	8.7	6.1	45.0
Old Castille 1752	7.0	6.2	52.5
Siam 1929	6.7	5.1	48.5
Average	*15.9*	*8.6*	*45.0*
Modern counterparts (based on household surveys)			
Chile 2003	14.6	7.9	54.6
Brazil 2001	14.1	8.3	58.8
Peru 2001	12.5	6.9	53.0
Mexico 2000	11.5	8.0	53.8
Thailand 2002	11.1	6.2	50.9
UK 1999	7.0	4.3	37.4
Turkey 2003 *	9.0	5.7	43.6
Indonesia 2002 *	6.9	4.2	34.3
Italy 2000	6.0	4.2	35.9
Spain 2000	5.6	4.0	33.0
India 2004 *	5.2	4.2	32.6
France 2000	4.5	3.5	31.2
Netherland 1999	3.6	2.9	28.1
Average	*8.6*	*5.4*	*42.1*
Modern counterparts (based on tax data and gross income)**			
US 1998	14.5		39.9
UK 2000	13.0		37.4
France 1998	7.8		31,2
Japan 2005	9.2		26.8

India 1999	9.0	36.0
Netherlands 1999	5.4	28.1

Note: Income distributions for Holland not available. The ancient data do not include geographically-based Ottoman surveys. All modern countries as calculated from LIS and World Income Distribution (WYD) databases (from micro data in all cases). The cut-off point indicates the income level (expressed in terms of country mean) where the top percentile begins. For the modern societies, it is estimated by taking the mean income of the 99th percentile and adding 3 standard deviations (of income within that percentile), or directly from the individual-level data. Ancient societies ranked in descending order according to the top 1% share.
* Consumption data.
** These results are from tax studies of the share of top percentiles of tax payers' gross (before tax) income in total national gross income. Note that the top income share in household surveys, calculated on disposable income basis, would be less than the top share calculated from tax data (which refer to gross income) even if household surveys did not undersample or underestimate income of the very rich.
Source: For United Kingdom and the Netherlands, Atkinson and Salvedra (2003, Table2NL and 2UK, pp. 21-24). For US and France, Piketty and Saez (2001,Figure 17). For Japan, Moriguchi and Saez (2007, Figure 4). For India, Banerji and Piketty (2005, Figure 4).

Figure 1

Derivation of the Inequality Possibility Frontier

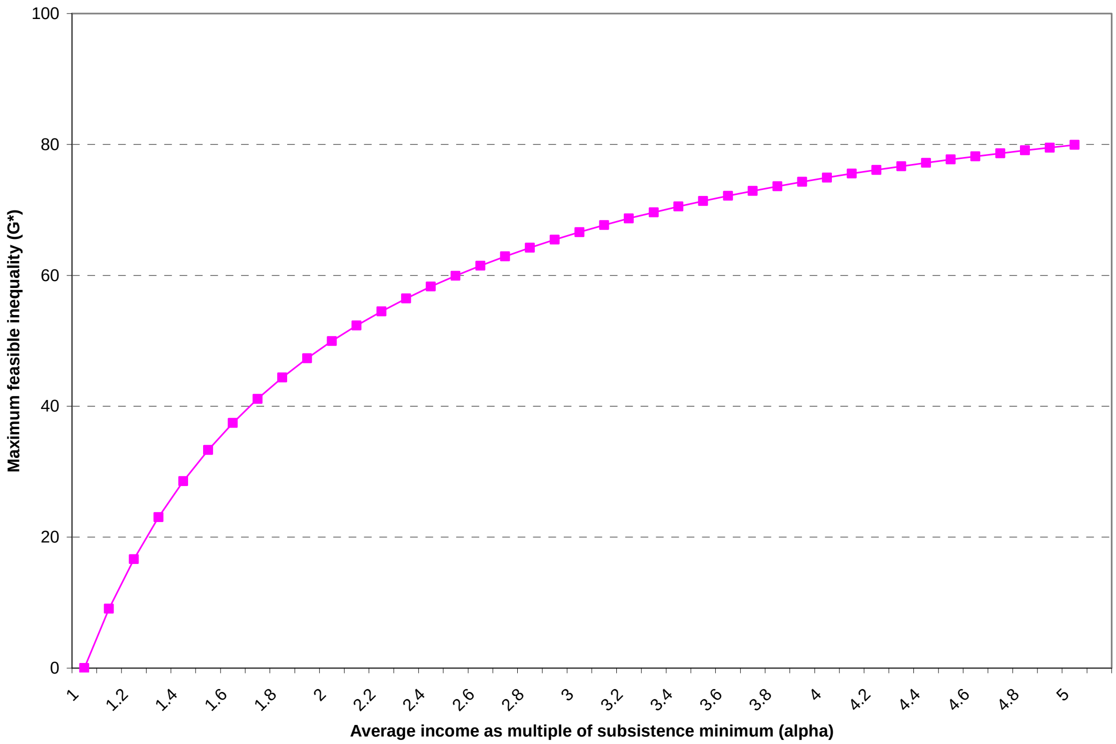
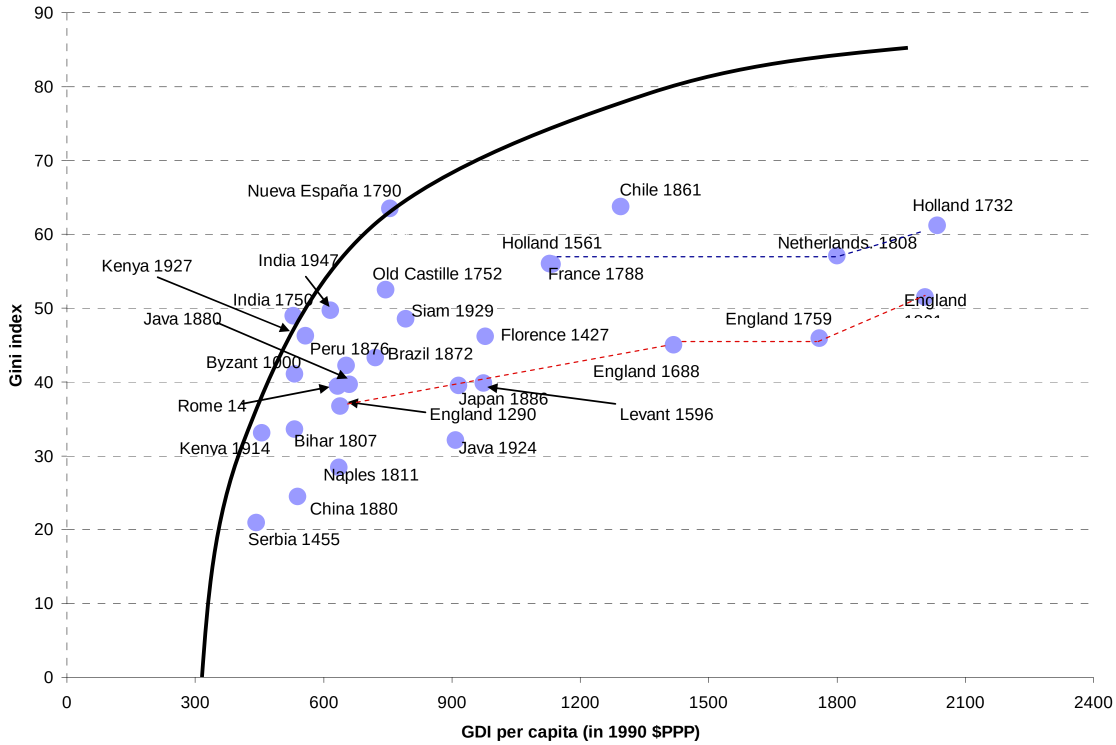
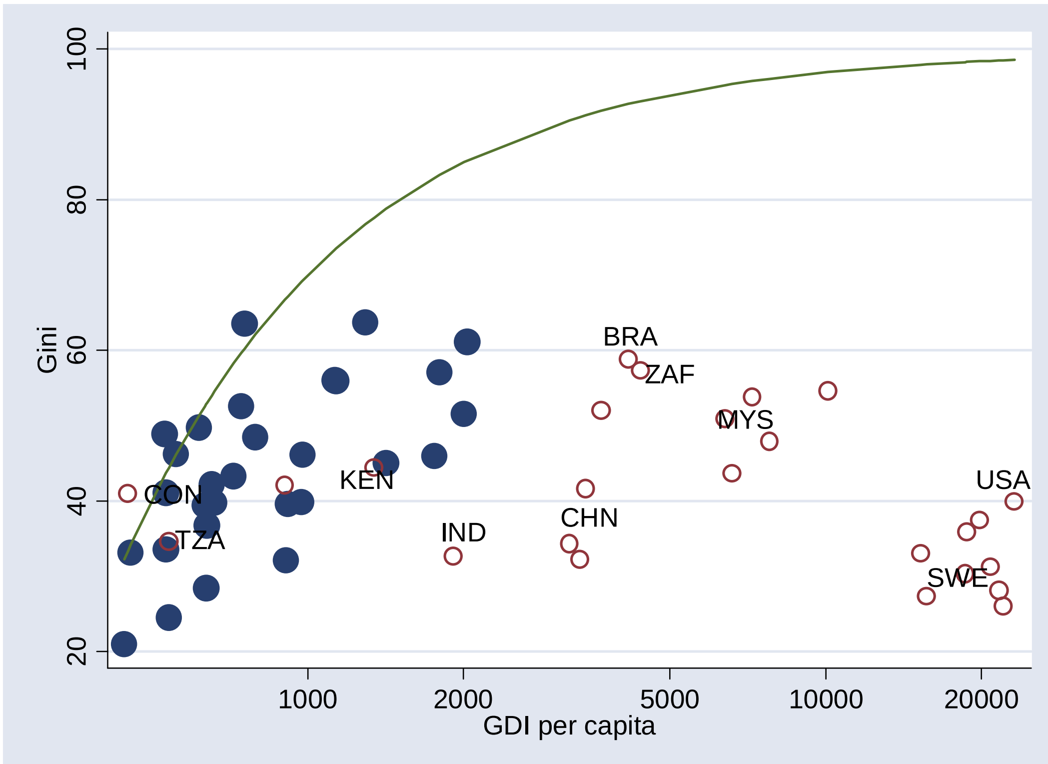


Figure 2
Ancient Inequalities: Estimated Gini Coefficients, and the Inequality Possibility Frontiers



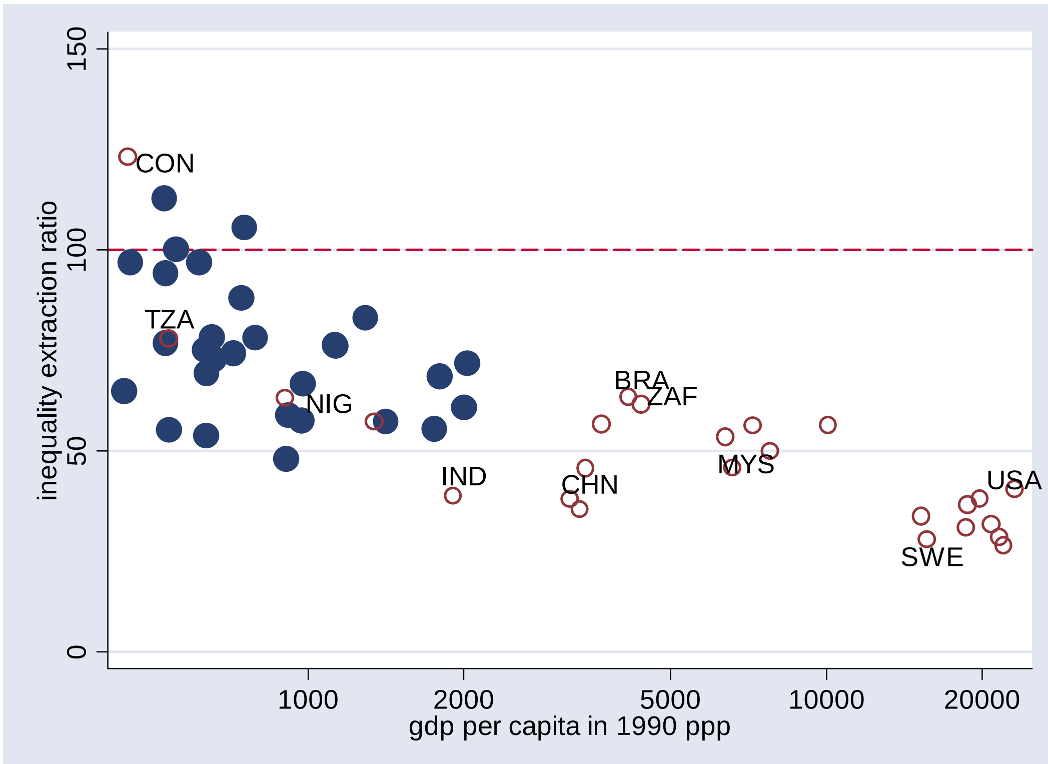
Note: The solid IPF line is constructed on the assumption that s=$PPP 300. The Gini index is estimated Gini2.

Figure 3
Ginis and the Inequality Possibility Frontier for the Ancient Society Sample and Selected Modern Societies



Note: Modern societies are drawn with hollow circles. IPF drawn on the assumption of s=$PPP 300 per capita per year. Horizontal axis in logs.

Figure 4
Inequality Extraction Ratio for the Ancient
Society Sample and their Counterpart Modern Societies



Note: Modern societies are drawn with hollow circles. Horizontal axis in logs. Inequality extraction ratio shown in percentages.

Figure 5. Relationship Between GDI Per Capita and Extraction Ratio

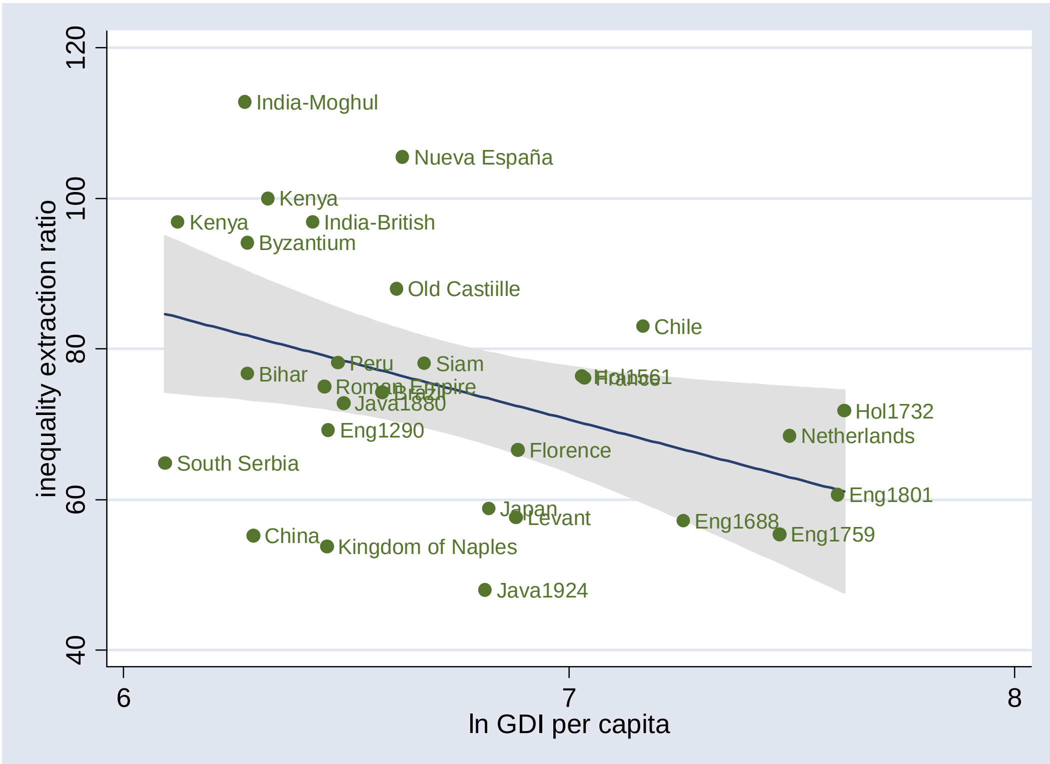
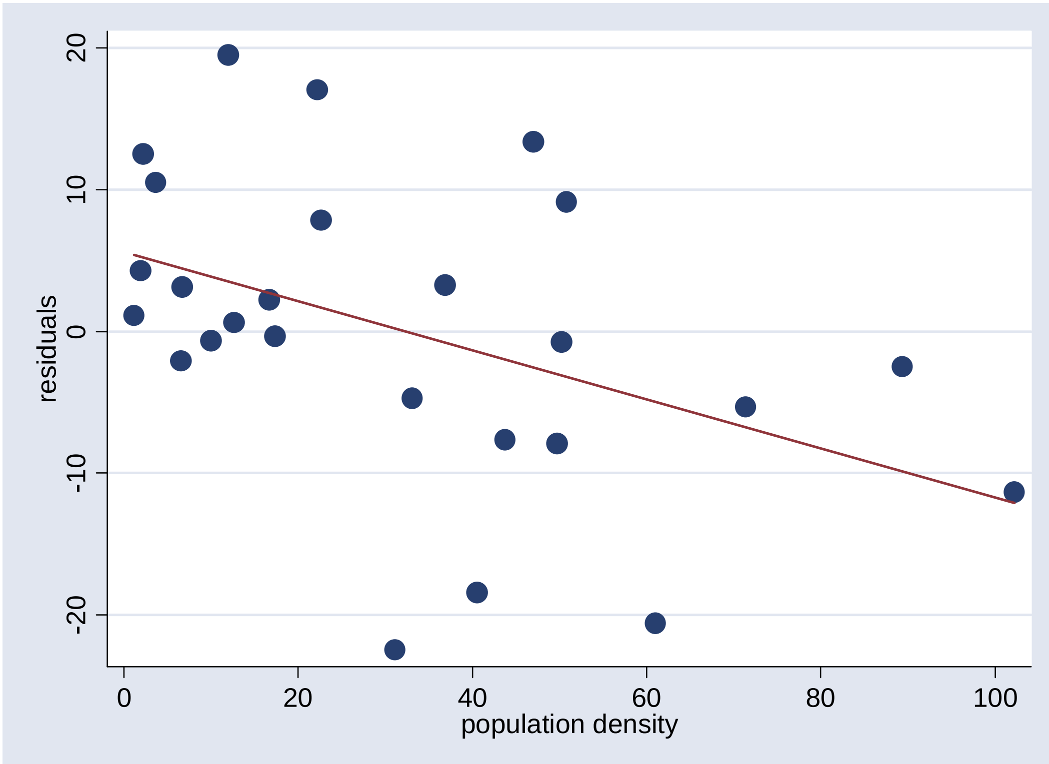
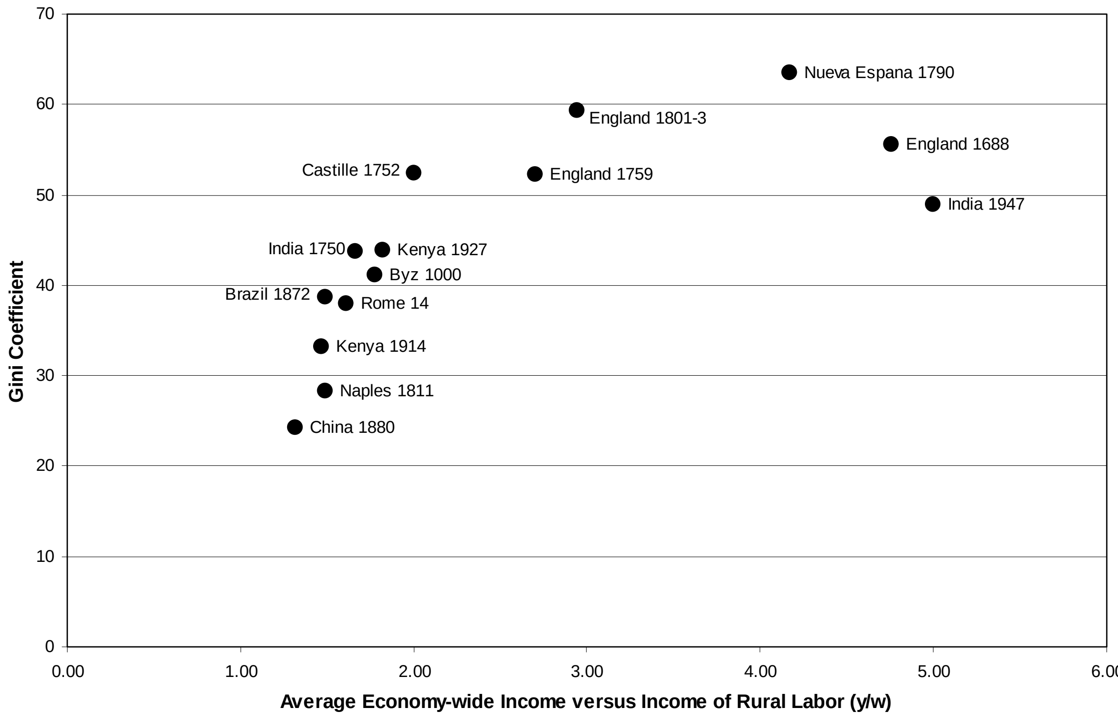


Figure 6. Population Density and Extraction Ratio
(conditional on control variables from Regression 6, Table 3)



Note: Residuals from regression 6 (Table 3) where the two observations for Java are excluded.

Figure 7. Gini versus the y/w Ratio in an Ancient Sample of Fourteen



Appendix 1: Data Sources
(Arranged alphabetically by country)

Bihar (India) 1807

Expenditure class	Percentage of population	Average monthly expenditure per capita (in rupees)	Income in terms of per capita mean
1	15.24	0.68	0.43
2	4.85	0.83	0.53
3	16.18	0.88	0.56
4	6.68	0.97	0.61
5	8.52	1.03	0.65
6	10.39	1.42	0.90
7	8.91	1.56	0.99
8	11.21	2.06	1.30
9	9.89	2.64	1.67
10	8.13	4.45	2.82
Total	*100*	*1.58*	*1*

Income distribution data: A household census survey was made by a British official (Hamilton) of Patna city and 16 rural districts in the region surrounding it, all of which we take to be representative of Bihar. He recorded family size and monthly family expenditures in rupees. The data are summarized by ten income groups, approximate deciles (Martin 1838).

Population and area: Population of 3,362,280 and area in km^2 from Martin (1838).

Urbanization rate: We use the rate for India (Jean-François Bergier and Jon Mathieu 2002: Table 1, 9-12% for 1800, based on Bairoch 1985 and Chandler 1987).

Mean income in $PPP: 1820 GDP per capita in 1990 international dollars (Maddison 2001: 264).

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Brazil 1872

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
72	223	0.004	0.23
100	1065836	17.626	0.32
108	1586	0.026	0.35
109	15	0.000	0.35
118	64263	1.063	0.38
120	62662	1.036	0.38
126	140	0.002	0.40
132	15	0.000	0.42
144	14261	0.236	0.46
155	45229	0.748	0.50
157	6736	0.111	0.50
161	239	0.004	0.52
163	426	0.007	0.52
175	677987	11.212	0.56
177	411664	6.808	0.57
178	86	0.001	0.57
179	874	0.014	0.57
180	292066	4.830	0.58
191	150	0.002	0.61
199	261	0.004	0.64
206	1466	0.024	0.66
207	16160	0.267	0.66
208	22	0.000	0.67
213	109	0.002	0.68
214	7	0.000	0.69
215	57619	0.953	0.69
218	60	0.001	0.70
229	142	0.002	0.73
232	272965	4.514	0.74
233	82	0.001	0.75
236	67294	1.113	0.76
237	182	0.003	0.76
240	6717	0.111	0.77
245	2872	0.047	0.79
247	962	0.016	0.79
250	18778	0.311	0.80
251	81	0.001	0.81
255	31	0.001	0.82
262	120545	1.994	0.84
266	623196	10.306	0.85
269	6088	0.101	0.86
270	64280	1.063	0.87
271	1925	0.032	0.87
272	2	0.000	0.87
282	24835	0.411	0.90

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
283	777	0.013	0.91
286	1305	0.022	0.92
287	321	0.005	0.92
288	35	0.001	0.92
293	69	0.001	0.94
295	10478	0.173	0.95
297	31	0.001	0.95
300	460770	7.620	0.96
306	104	0.002	0.98
309	9423	0.156	0.99
310	54157	0.896	0.99
312	161	0.003	1.00
319	2156	0.036	1.02
323	1671	0.028	1.04
327	1254	0.021	1.05
340	31	0.001	1.09
343	848	0.014	1.10
348	399884	6.613	1.12
350	3236	0.054	1.12
354	179708	2.972	1.14
356	1499	0.025	1.14
359	86	0.001	1.15
360	41102	0.680	1.15
366	1	0.000	1.17
370	2410	0.040	1.19
377	1051	0.017	1.21
379	161	0.003	1.22
383	31	0.001	1.23
387	7699	0.127	1.24
391	1	0.000	1.25
394	8	0.000	1.26
397	620	0.010	1.27
406	4818	0.080	1.30
408	440	0.007	1.31
413	42	0.001	1.32
424	217	0.004	1.36
425	5494	0.091	1.36
431	7091	0.117	1.38
432	706	0.012	1.39
436	15	0.000	1.40
439	856	0.014	1.41
443	33797	0.559	1.42
445	11	0.000	1.43
450	10174	0.168	1.44
459	1181	0.020	1.47
460	69	0.001	1.48
464	81407	1.346	1.49

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
468	161	0.003	1.50
472	9195	0.152	1.51
475	468	0.008	1.52
476	3	0.000	1.53
479	8	0.000	1.54
480	226013	3.738	1.54
490	3655	0.060	1.57
502	17	0.000	1.61
503	34	0.001	1.61
531	93744	1.550	1.70
533	2078	0.034	1.71
534	180	0.003	1.71
538	597	0.010	1.73
540	1782	0.029	1.73
544	80	0.001	1.74
545	161	0.003	1.75
546	723	0.012	1.75
549	65	0.001	1.76
550	941	0.016	1.76
552	6	0.000	1.77
554	181	0.003	1.78
565	597	0.010	1.81
572	75	0.001	1.83
574	34	0.001	1.84
576	104	0.002	1.85
580	19272	0.319	1.86
585	69	0.001	1.88
586	155	0.003	1.88
587	3	0.000	1.88
591	18874	0.312	1.90
593	7	0.000	1.90
594	659	0.011	1.91
595	4322	0.071	1.91
600	9123	0.151	1.92
612	3003	0.050	1.96
613	35	0.001	1.97
619	3849	0.064	1.99
620	498	0.008	1.99
623	303	0.005	2.00
628	103	0.002	2.01
637	155	0.003	2.04
641	16	0.000	2.06
646	239	0.004	2.07
648	3544	0.059	2.08
650	546	0.009	2.08
654	261	0.004	2.10
658	787	0.013	2.11

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
659	5	0.000	2.11
663	161	0.003	2.13
664	1214	0.020	2.13
668	75	0.001	2.14
679	31	0.001	2.18
680	6	0.000	2.18
689	802	0.013	2.21
696	28907	0.478	2.23
701	69	0.001	2.25
708	37669	0.623	2.27
709	1878	0.031	2.27
712	3243	0.054	2.28
713	798	0.013	2.29
718	706	0.012	2.30
719	119	0.002	2.31
720	40182	0.665	2.31
722	1	0.000	2.32
732	46	0.001	2.35
750	113	0.002	2.41
753	550	0.009	2.42
763	75	0.001	2.45
764	62	0.001	2.45
768	36	0.001	2.46
771	981	0.016	2.47
774	1925	0.032	2.48
778	61	0.001	2.50
788	31	0.001	2.53
793	1641	0.027	2.54
797	1183	0.020	2.56
815	1287	0.021	2.61
816	2	0.000	2.62
817	1305	0.022	2.62
819	8138	0.135	2.63
820	4024	0.067	2.63
828	1501	0.025	2.66
829	1	0.000	2.66
831	26	0.000	2.67
832	2291	0.038	2.67
840	1419	0.023	2.69
849	248	0.004	2.72
850	354	0.006	2.73
859	75	0.001	2.76
861	239	0.004	2.76
864	1355	0.022	2.77
878	787	0.013	2.82
880	1555	0.026	2.82
885	41939	0.694	2.84

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
886	3698	0.061	2.84
890	4593	0.076	2.85
899	3272	0.054	2.88
900	70	0.001	2.89
919	394	0.007	2.95
928	9636	0.159	2.98
929	962	0.016	2.98
934	991	0.016	3.00
941	884	0.015	3.02
945	151	0.002	3.03
950	432	0.007	3.05
954	528	0.009	3.06
955	2532	0.042	3.06
956	1006	0.017	3.07
958	4	0.000	3.07
984	335	0.006	3.16
985	8	0.000	3.16
992	556	0.009	3.18
1019	1809	0.030	3.27
1026	155	0.003	3.29
1034	1139	0.019	3.32
1050	787	0.013	3.37
1056	155	0.003	3.39
1062	14715	0.243	3.41
1063	156	0.003	3.41
1068	1261	0.021	3.43
1076	955	0.016	3.45
1077	17	0.000	3.45
1080	737	0.012	3.46
1082	731	0.012	3.47
1088	1	0.000	3.49
1089	30	0.000	3.49
1092	2713	0.045	3.50
1093	671	0.011	3.51
1097	394	0.007	3.52
1098	5	0.000	3.52
1151	502	0.008	3.69
1153	139	0.002	3.70
1160	4818	0.080	3.72
1166	139	0.002	3.74
1173	311	0.005	3.76
1181	8972	0.148	3.79
1182	12	0.000	3.79
1187	65	0.001	3.81
1190	11526	0.191	3.82
1200	103	0.002	3.85
1210	692	0.011	3.88

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
1223	643	0.011	3.92
1242	214	0.004	3.98
1245	90	0.001	3.99
1246	155	0.003	4.00
1273	31	0.001	4.08
1296	1969	0.033	4.16
1299	36	0.001	4.17
1320	437	0.007	4.23
1327	543	0.009	4.26
1328	2166	0.036	4.26
1349	741	0.012	4.33
1358	31	0.001	4.36
1365	362	0.006	4.38
1386	181	0.003	4.45
1392	2409	0.040	4.46
1417	1731	0.029	4.55
1424	1171	0.019	4.57
1425	26	0.000	4.57
1431	377	0.006	4.59
1436	388	0.006	4.61
1441	104	0.002	4.62
1464	22	0.000	4.70
1466	155	0.003	4.70
1477	569	0.009	4.74
1487	3872	0.064	4.77
1512	813	0.013	4.85
1526	75	0.001	4.89
1558	322	0.005	5.00
1560	254	0.004	5.00
1576	4	0.000	5.06
1587	13	0.000	5.09
1594	1204	0.020	5.11
1600	1984	0.033	5.13
1614	119	0.002	5.18
1631	214	0.004	5.23
1634	522	0.009	5.24
1638	3436	0.057	5.25
1639	335	0.006	5.26
1661	13	0.000	5.33
1662	26	0.000	5.33
1717	151	0.002	5.51
1728	1575	0.026	5.54
1729	69	0.001	5.55
1759	155	0.003	5.64
1771	17197	0.284	5.68
1772	949	0.016	5.68
1780	450	0.007	5.71

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
1784	630	0.010	5.72
1795	17	0.000	5.76
1799	716	0.012	5.77
1800	451	0.007	5.77
1830	5	0.000	5.87
1868	450	0.007	5.99
1890	42	0.001	6.06
1899	26	0.000	6.09
1908	604	0.010	6.12
1948	502	0.008	6.25
1953	13	0.000	6.26
1970	4	0.000	6.32
1984	246	0.004	6.36
2000	14255	0.236	6.42
2039	164	0.003	6.54
2052	155	0.003	6.58
2077	78	0.001	6.66
2125	300	0.005	6.82
2136	180	0.003	6.85
2153	716	0.012	6.91
2154	51	0.001	6.91
2160	1181	0.020	6.93
2184	904	0.015	7.01
2186	1341	0.022	7.01
2279	123	0.002	7.31
2290	226	0.004	7.35
2362	73	0.001	7.58
2363	285	0.005	7.58
2374	103	0.002	7.61
2379	90	0.001	7.63
2400	1190	0.020	7.70
2457	181	0.003	7.88
2491	90	0.001	7.99
2492	180	0.003	7.99
2500	132	0.002	8.02
2592	787	0.013	8.31
2600	66	0.001	8.34
2656	1852	0.031	8.52
2691	119	0.002	8.63
2732	335	0.006	8.76
2833	100	0.002	9.09
2848	180	0.003	9.14
2862	75	0.001	9.18
2882	35	0.001	9.24
2928	90	0.001	9.39
2953	285	0.005	9.47
2974	1711	0.028	9.54

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
2975	26	0.000	9.54
3000	5620	0.093	9.62
3053	75	0.001	9.79
3113	540	0.009	9.99
3200	66	0.001	10.26
3229	358	0.006	10.36
3275	362	0.006	10.50
3519	155	0.003	11.29
3541	1371	0.023	11.36
3543	36	0.001	11.36
3560	720	0.012	11.42
3561	13	0.000	11.42
3600	66	0.001	11.55
3906	13	0.000	12.53
3967	78	0.001	12.72
4000	7703	0.127	12.83
4320	394	0.007	13.86
4461	180	0.003	14.31
4675	161	0.003	15.00
4748	78	0.001	15.23
4799	448	0.007	15.39
4800	464	0.008	15.40
5000	1520	0.025	16.04
5312	694	0.011	17.04
5339	90	0.001	17.13
5459	181	0.003	17.51
5856	90	0.001	18.78
5859	13	0.000	18.79
5936	13	0.000	19.04
5948	540	0.009	19.08
6000	3774	0.062	19.25
7119	540	0.009	22.83
7123	39	0.001	22.85
8000	934	0.015	25.66
8784	90	0.001	28.18
8899	90	0.001	28.54
9598	138	0.002	30.79
10000	244	0.004	32.08
10679	270	0.004	34.25
12000	403	0.007	38.49
14000	75	0.001	44.91
14396	64	0.001	46.18
19195	34	0.001	61.57
20000	132	0.002	64.15
23994	22	0.000	76.96
28793	3	0.000	92.36
30000	66	0.001	96.23
33592	35	0.001	107.75

Occupational income (in milreis per annum)	Number of people in occupation	Percentage of people in occupation	Income in terms of per capita mean
Total	*6046811*	*100*	*1*

Income distribution data: The occupational data come from the Brazilian 1872 Census. The annual incomes by occupation were estimated by the team of economic historians Bértola, Castelnovo, Reis and Willebald (2006). The original data include 813 professional groups. For simplicity they are consolidated in the table shown above: different professions with the same estimated income are summed up.

Population and area: Current land area of Brazil. Population from Maddison (2004).

Urbanization rate: The 1872 urbanization rate (share of cities 5,000 or greater) is 16.2 percent, interpolated between 1850 and 1900 from Bairoch (1985, Table 26/3, p. 542). The figure refers to all Latin America, of which Brazil was 33% in 1870 (Maddison 2004).

Mean income in $PPP: From Maddison (2004).

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Byzantium 1000

Social group	Percentage of population	Per capita income (in *nomismas* per annum)	Income in terms of per capita mean
Tenants (on land)	37	3.5	0.56
Urban 'marginals'	2	3.5	0.56
Farmers	52	3.8	0.61
Workers	3	6	0.97
Army, navy	1	6.5	1.05
Traders, skilled craftsmen	3.5	18	2.90
Large landowners	1	25	4.02
Nobility (civilian and military)	0.5	350	56.31
Total	*100*	*6.22*	*1*

Notes: Nobility includes civil and military nobility. The average household size estimated at 4.3 (see Lefort, 2002).

Income distribution data: Taken directly from Milanovic (2006: Table 5, p. 465). Rural incomes are based mostly on Lefort (2002) who quantifies population shares and incomes of several classes; rural population is divided into tenants (*pariokoi*); farmers that include both landowning peasants and (not very numerous) hired farm workers and slaves working on large estates; and large landowners. Urban population is, following Morrisson and Cheynet (2002), divided into four classes plus nobility (both civilian and military). Additional explanations given in Milanovic (2006: pp. 461-8).

Other incomes and wages (for comparison and illustrative purposes):

	Amount in nomisma	Amounts in terms of the estimated average annual income	Source
Heads of *themes* (administrative units) annual wage (around year 900)	360 to 720	58 to 115	Ostrogorsky (1969, p. 246)
Heads of the three most important *themes* (around year 900)	2880	~460	Ostrogorsky (1969, p. 246)
Military commanders	144	23	Morrisson and Cheynet (2002, p. 861)

Population and area: For population, see Milanovic (2006, p. 461). It is a compromise estimate (15 million) based on Treadgold (2001), Andreades (1924) and Harl (1996). Area: Treadgold (2001, p. 5).

Urbanization rate: See Milanovic (2006, p. 461), based on Bairoch's (1985) cut-off point of 5,000 inhabitants.

Mean income in $PPP: Average income (6.22 *nomisma*) divided by the estimated subsistence minimum (3.5 *nomisma*), and the latter priced at $PPP 300 at 1990 international prices. This gives (6.22/3.5*300) mean income of $533 in $PPPs. From Milanovic (2006, pp. 456-7).

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Chile 1860-1862

	Income per Recipient	Recipients	Income (pesos)
Agriculture and fishing			
landowners	7498	850	6373300
medianos	1200	5359	6430800
campesinos	89	132946	11832194
gañanes y pescadores			
males	59	143640	8474760
females	33	2662	87846
Mining			
patrones	11579	475	5500025
empleados hombres	374	2139	799986
barreteros	187	6445	1205215
Manufacturing and Construction			
industriales			
apires	139	12891	1791849
males	4586	4345	19926170
artisansos (male)	4586	65026	298209236
costureras (female)	134	154	20636
artesanos calificados			
female	74	98260	7271240
male	370	13171	4873270
zapateros			
female	204	432	88128
male	137	13106	1795522
Commerce			
patrones			
female	75	2151	161325
male	1878	8665	16272870
empleados			
female	1878	1567	2942826
male	876	5754	5040504
obreros			
female	482	1041	501762
male	501	3016	1511016
Transport and Communications			
ferrocarrileros			
female	275	546	150150
male	361	1106	399266
marinos	301	1672	503272
conductores			
male	180	2049	368820
female	101	2	202
Services			
domésticos y lavanderas			
male	86	7703	662458
female	48	52922	2540256

profesionales			
male	1084	7226	7832984
female	813	2800	2276400
funcionarios			
male	401	2486	996886
female	301	22	6622
militares y policias (male)	144	6993	1006992
Total	685	609624	417854788

Income distribution data. Based on occupational census data taken from the Chilean Census. Annual income is in pesos. The data underlies the decile summary in Table 1 of Rodriguez Weber (2007: p. 12). The decile data consolidate the many occupations listed above, including landowners and merchants, and were sent to us by Javier Rodriguez Weber.

Population and area. Current land area of Chile 756,950 km^2. 1861 population was 1,702,724, from Braun et al. (2000: p. 215).

Urbanization rate. The 1865 urbanization rate (share of those residing in urban areas 5,000 or greater) was 29 percent (Braun et al. 2000: p. 233).

Mean income in 1990 $PPP. Maddison (2004: p. ?) reports [Jeff is in transit: can Branko fill in the blanks here, please?].

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China 1880

Social group	Population (in 000)	Percentage of population	Total income (in taels)	Income as a share of total income (%)	Income per capita (in *taels* per annum)	Income in terms of per capita mean
Commoners	370000	98	1821047	74.4	4.92	0.76
Gentry	7500	2	627725	25.6	83.7	12.9
Lower gentry	6450	1.7	247605	10.1	38.4	5.91
Upper gentry	1050	0.3	380120	15.5	362.0	55.7
Total	*377500*	*100*	*2448772*	*100*	*6.5*	*1*

Income distribution data: The calculations are based on Chang (1962, Supplement 2: "The gentry's share in the national product," pp. 326-333).

Gentry per capita incomes.

The supplement provides a careful breakdown of gentry incomes by different sources, division of these income sources between upper and lower gentry, and the population shares of both types of gentry (see the table below which is derived from Chang's Supplement 2). The rest of the book gives the data on Chinese GDP and taxes from which one can calculate total household disposable income, and when combining this information with the estimates of gentry total income and its share in the Chinese population, calculate gentry's (upper's and lower's) per capita incomes (see the last line in the table below).

The main sources of gentry income, according to Chang, are:

(i) Government office-holding (administration) which was confined to gentry only. Income from government jobs provided resources for purchase of land and thus income from landownership. Land was a much less important source of income than at a similar stage in European history.

(ii) Gentry service in local affairs (managerial income); basically local administration.

(iii) Assistants to officials (secretarial services).

(iv) Teaching. Unlike the first three, they are private services. Only higher education (teaching) was monopolized by the gentry.

(v) Other services include medicine, writing etc. They are of much smaller importance.

In professions (i) to (iii) actual incomes (as calculated by Chang) were several times larger than the official wages. It was a policy to keep official wages low and give large premiums (the *yang-lien* allowance, see Chang p.13).

Commoners' per capita incomes. Once gentry per capita incomes are derived, commoners' incomes are obtained as the residual (using total household disposable income, line *d* in Table below, minus gentry's total income, and dividing by commoners' total population). The estimated commoners' per capita income of 4.92 taels should be contrasted with the estimated subsistence minimum (based on wage data), which was around 5 taels (Chang). If we consider Maddison's (2004) estimate that China's GDI per capita was $PPP 540 and Chang's average income of 6.5 taels to be the same (as they should be), then the subsistence minimum of $300 works out to be 3.7 taels. This indirectly obtained subsistence minimum is quite close to the directly calculated one (from Chang) of around 5 taels per annum. This further corroborates both the subsistence minimum and the average figures.

Derivation of incomes of the upper and lower gentry

		Income shares:		Estimated total income	
Source of gentry income	Estimated amounts (in 000 *taels*)	Upper gentry	Lower gentry	Upper gentry	Lower gentry
	(1)	(2)	(3)	(1)x(2)	(1)x(3)
Office-holding	121000	1	0	121000	0
Gentry service	111000	0.18	0.82	20250	90750
Secretarial services	9050	0	1	0	9050
Teaching	61575	0	1	0	61575
Other services 1/	9000	0.2	0.8	1800	7200
Landholding	220000	0.7	0.3	154000	66000
Mercantile activity	113600	0.7	0.3	79520	34080
Total gentry income	645225			376570	268655
plus Imputed rent	30000	0.34	0.66	10200	19800
m*inus* direct taxes	47500	0.14	0.86	6650	40850
(a) Disposable gentry income	627725			380120	247605
(b) China-wide GNP	2781272				
(c) Total taxes	332500				
(d) Household disposable income: (b)-(c)	2448772				
(e) Gentry population (in 000 people)	7500	0.14	0.86	1050	6450
Disposable income (in tael per capita p.a.) = (a)/(e)				*362.0*	*38.4*

Sources: Gentry incomes, Table 26, page 197. Imputed rent and GDP, p. 326. Number of gentry: p. 327 (average household size = 5). Direct taxes: p. 329. Upper and lower gentry shares in total gentry income: p. 330. All references to Chung-li Chang (1962).

1/ Upper and lower gentry's shares for other services assumed.

Other incomes and wages (for comparison and illustrative purposes):

Position	(1) Official wage (taels p.a.)	*(2) Yang lien*(taels p.a.)	(1)+(2) in terms of the estimated overall income mean	Source
District magistrate	45	1000	~160	Chang, p.13
Governor	150	12000	~1900	Chang, p.13
Highest level military rank*	605		93	Chang, p.13
Seventh level military rank*	36		5.5	Chang, p.13
Highest level court official*	307		47	Chang, p.35
Ninth level court official*	54.4		8.3	Chang, p.35

*/ Wages include income in kind. Note: *Yang lien* is an allowance paid on top of the official wage.

Population and area: Population from Maddison (2004). Area: Current area of the People's Republic of China plus Taiwan.

Urbanization rate: From Bairoch (1985, p. 462). Based on population living in towns that are greater than 5,000 inhabitants. (See also Bairoch, 1985, p. 517: urbanization rate for 1900 estimated at between 7.5 and 8 percent.) Chao (1995, p.76), cited in Wen (2008, p.30), gives urbanization rate as 7.7 percent for year 1893.

Mean income in $PPP: From Maddison (2004).

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England and Wales 1290

Social group	Number of people	Percentage of population	Per capita income (in £ per annum)	Income in terms of per capita mean
Cottagers etc.	1276040	29.68	2	0.47
Smallholders	1270688	29.55	3	0.70
Minor clergy, lawyers	658507	15.31	4	0.94
Miners, soldiers	90182	2.10	4	0.94
Yardlanders	762413	17.73	5	1.17
Substantial tenants	71159	1.65	10	2.35
Landowners	171014	3.98	26	6.10
Total	*4300001*	*100*	*4.26*	*1*

Income distribution data: Estimated social tables are taken from Bruce Campbell (2007, Table 17, p. 45). They are based on seminal socio-economic reconstruction of England circa 1300 produced by N. J. Mayhew (1995).

Territory and population: Current area of England and Wales is assumed. Population as given in Campbell (2007).

Urbanization rate: The population-weighted average of the urbanization rates for England (15%) and Wales (9%), given in Campbell (2007, Table 16, p. 36).

Mean income in $PPP: Based on the assumption that the subsistence minimum is 2 pounds per year (the estimated income of the vagrants and paupers by Campbell). Taking this value to equal $300 in 1990 international prices converts the estimated mean income per capita income from Campbell's data (3.68 pounds) into $PPP 552.

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England and Wales, 1688

Social group	Number of people	Percentage of population	Per capita income (in £ per annum)	Income in terms of per capita mean
Cottagers and paupers	1017845	17.89	2	0.21
Vagrants	23489	0.41	2	0.21
Miners	64080	1.13	3.3	0.35
Laboring people, outservants	997489	17.53	4.3	0.45
Building trades	328581	5.78	5.6	0.58
Common seamen	150000	2.64	6.7	0.7
Common soldiers	70000	1.23	7	0.73
Manufacturing trades	732883	12.88	8.4	0.88
Farmers	516910	9.09	8.5	0.89
Clergymen, lesser	50000	0.88	10	1.05
Shopkeepers and tradesmen	457668	8.04	10	1.05
Freeholders, lesser	482450	8.48	11	1.15
Science and Liberal Arts	64490	1.13	12	1.25
Freeholders, greater	192976	3.39	13	1.36
Clergymen, greater	10000	0.18	14.4	1.5
Military officers	16000	0.28	15	1.57
Persons in offices, lesser	30000	0.53	20	2.09
Naval officers	20000	0.35	20	2.09
Law	56434	0.99	22	2.3
Persons in offices, greater	40000	0.7	30	3.14
Merchants by sea, lesser	48000	0.84	33.3	3.48
Merchants on land, lesser	78342	1.38	33.3	3.48
Gentlemen	120000	2.11	35	3.66
Merchants by sea, greater	16000	0.28	50	5.23
Artisans and handicrafts	26980	0.47	50	5.23
Esquires	30000	0.53	56.3	5.88
Knights	7800	0.14	61.5	6.43
Spiritual lords	520	0.01	65	6.79
Merchants on land, greater	19584	0.34	66.7	6.97
Baronets	12800	0.22	93.8	9.8
Temporal lords	8000	0.14	151.5	15.83
Total	*5689322*	*100*	*9.57*	*1*

Income distribution data: The source is the Lindert-Williamson (1982) revision of Gregory King's social table (available at http://gpih.ucdavis.edu / early income distributions, and also at Peter Lindert's home page). The data originally presented on per household basis are transformed on per capita basis (each individual is assigned per capita income of his/her household) using King's estimates of average household size by social group.

Population and area: Current territory of England and Wales. Population: obtained directly from King's numbers.

Urbanization rate: Bairoch (1985: Table 13/1, p. 279) gives the year 1700 range (based on cities greater than 5,000) to be 13 to 16 percent. For 1688, we have used the lower bound of the range (13 percent).

Mean income in $PPP: Obtained by interpolation from Maddison's (2001, p. 247) estimates of English and Welsh GDI per capita in 1600 and 1700 ($PPP 1418). An alternative calculation based directly on King's estimates yield almost the same result. If we take the ratio between the mean income from King's social table (9.6 pounds per capita per annum) and the subsistence minimum (assumed to be the same as vagrants' income of 2.7 pounds, as given by King), we get an estimated mean income that is 4.8 times the subsistence. This, combined with the assumption of a subsistence minimum of $PPP 300, yields an average income of $PPP 1440 which is within 2 percentage points of the interpolation based on Maddison's data.

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England and Wales 1759

Social group	Number of people	Percentage of population	Per capita income (in £ per annum)	Income in terms of per capita mean
Cottagers & paupers	581399	8.8	2.2	0.21
Husbandmen	670800	10.15	3.2	0.32
Vagrants	13418	0.2	3.2	0.32
Ale-sellers, cottagers (lsr.)	90000	1.36	4.4	0.44
Laborers, country	700000	10.59	4.6	0.46
Mining	64350	0.97	5.1	0.51
Building trades (country)	484052	7.33	5.6	0.55
Manuf wood, iron (country)	315328	4.77	5.6	0.55
Manuf wool, silk (country)	315328	4.77	5.6	0.55
Common seamen, fishermen	180000	2.72	6.7	0.66
Common soldiers	36000	0.54	7.0	0.69
Laborers, London	70000	1.06	7.9	0.78
Farmers 4	402490	6.09	8.0	0.79
Civil officers	112000	1.69	8.6	0.85
Tradesmen 5	562500	8.51	8.9	0.88
Ale-sellers, cottagers (gtr.)	90000	1.36	8.9	0.88
Master manufacturers 4	280007	4.24	8.9	0.88
Building trades (London)	17595	0.27	9.2	0.91
Manuf. wood, iron (London)	44147	0.67	9.2	0.91
Manuf. Wool, silk (London)	44143	0.67	9.2	0.91
Freeholders 3	321992	4.87	9.5	0.94
Clergymen, inferior	45000	0.68	10.0	0.99
Liberal Arts	90000	1.36	12.0	1.19
Farmers 3	67085	1.02	14.0	1.38
Tradesmen 4	90000	1.36	15.6	1.54
Innkeepers 2	13500	0.2	15.6	1.54
Master manufacturers 3	44801	0.68	15.6	1.54
Freeholders 2	160996	2.44	19.0	1.88
Farmers 2	33540	0.51	20.0	1.98
Naval officers	24000	0.36	20.0	1.98
Clergymen, superior	10000	0.15	20.0	1.98
Freeholders 1	140868	2.13	21.7	2.15
Tradesmen 3	45000	0.68	22.2	2.2
Innkeepers and ale-sellers	9000	0.14	22.2	2.2
Master manufacturers 2	22401	0.34	22.3	2.21
Military officers	8000	0.12	25.0	2.47
Law	84000	1.27	28.6	2.82
Farmers 1	16770	0.25	30.0	2.97
Merchants 3	60000	0.91	33.3	3.3
High titled classes, 12	51200	0.77	33.6	3.32
Tradesmen 2	22500	0.34	44.4	4.39
Master manufacturers 1	11200	0.17	44.6	4.41

Social group	Number of people	Percentage of population	Per capita income (in £ per annum)	Income in terms of per capita mean
High titled classes, 11	38400	0.58	50.5	4.99
High titled classes, 10	32000	0.48	53.9	5.33
High titled classes, 8	16000	0.24	53.9	5.33
High titled classes, 9	20800	0.31	62.2	6.14
Merchants 2	12000	0.18	66.7	6.59
Merchants 1	8000	0.12	75.0	7.41
High titled classes, 7	10240	0.15	84.2	8.32
Tradesmen 1	11250	0.17	88.9	8.79
High titled classes, 6	5120	0.08	168.4	16.65
High titled classes, 4	3200	0.05	202.1	19.98
High titled classes, 3	1600	0.02	269.4	26.63
High titled classes, 5	2560	0.04	336.8	33.29
High titled classes, 2	800	0.01	336.8	33.29
High titled classes, #1	400	0.01	673.5	66.58
Total	*6607780*	*100*	*10.12*	*1*

Income distribution data: From Massie's 1759 table as revised by Lindert and Williamson (1982), also available as an Excel file at http://gpih.ucdavis.edu / early income distributions, and on Lindert's home page. The household size estimated for various social groups from contemporary sources.

Territory and population: Current area of England and Wales is assumed. Population obtained from Brian Mitchell (1988, p. 7) who quotes the Wrigley-Schofield (1981) figure of 6,063,000 for England less Monmouth in 1759 (no data for England and Wales for dates before 1801 are given). For 1801, Mitchell gives 8,893,000 for England and Wales. Since at the same time Wales's population is estimated at 541 thousand and Monmouth's at 46 thousands, this implies that the ratio between England and Wales (on the one hand) and England without Monmouth (on the other) was 1.07. Applying this ratio to the 1759 figure given by Mitchell yields the final estimate of 6,463,200.

Urbanization rate: Estimated from Allen (2003).

Mean income in $PPP: Interpolation from Maddison (2001, p. 247).

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England and Wales, 1801-3

Social group	Number of people	Percentage of population	Per capita income (in £ per annum)	Income in terms of per capita mean
Paupers	1040716	11.5	2.5	0.11
Persons imprisoned for debt	10000	0.11	6	0.27
Laborers in husbandry	1530000	16.9	6.9	0.31
Hawkers, pedlars, duffers	4000	0.04	8	0.36
Laborers in mines, canals	180000	1.99	8.9	0.41
Vagrants	175218	1.94	10	0.46
Artisans, mechanics, laborers	2005767	22.16	12.2	0.56
Clerks and shopmen	300000	3.31	15	0.68
Freeholders, lesser	600000	6.63	18	0.82
Farmers	960000	10.6	20	0.91
Innkeepers and publicans	250000	2.76	20	0.91
Lesser clergymen	50000	0.55	24	1.09
Dissenting clergy, itinerants	12500	0.14	24	1.09
Education of youth	120000	1.33	25	1.14
Military officers	65320	0.72	27.8	1.27
Common soldiers	121985	1.35	29	1.32
Naval officers	35000	0.39	29.8	1.36
Shopkeepers and tradesmen	372500	4.11	30	1.37
Tailors, milliners, etc.	125000	1.38	30	1.37
Confined lunatics	2500	0.03	30	1.37
Freeholders, greater	220000	2.43	36.4	1.66
Marines and seamen	52906	0.58	38	1.73
Lesser offices	52500	0.58	40	1.82
Engineers, surveyors, etc.	25000	0.28	40	1.82
Merchant service	49393	0.55	40	1.82
Keeping houses for lunatics	400	0.004	50	2.28
Theatrical pursuits	4000	0.04	50	2.28
Liberal arts and sciences	81500	0.9	52	2.37
Law, judges to clerks	55000	0.61	70	3.19
Eminent clergymen	6000	0.07	83.3	3.8
Gents	160000	1.77	87.5	3.99
Shipowners, freight	25000	0.28	100	4.56
Higher civil offices	14000	0.15	114.3	5.21
Lesser merchants, by sea	91000	1.01	114.3	5.21
Building & repairing ships	1800	0.02	116.7	5.32
Warehousemen, wholesale	3000	0.03	133.3	6.08
Manufacturers	150000	1.66	133.3	6.08
Knights	3500	0.04	150	6.84
Esquires	60000	0.66	150	6.84
Educators in universities	2000	0.02	150	6.84
Baronets	8100	0.09	200	9.12
Eminent merchants, bankers	20000	0.22	260	11.86
Spiritual peers	390	0.004	266.7	12.16
Temporal peers	7175	0.08	320	14.59

Social group	Number of people	Percentage of population	Per capita income (in £ per annum)	Income in terms of per capita mean
Total	*9053170*	*100*	*21.93*	*1*

Income distribution data: Based on Colquhoun 1801-3 social table revised by Lindert and Williamson (1982), also available as an Excel file at http://gpih.ucdavis.edu/early income distributions, and on Lindert's home page. The data originally presented on per household basis are transformed on per capita basis (each individual is assigned per capita income of his/her household) using Colquhoun's estimates of average household size by social group.

Population and area: Current territory of England and Wales. Population: Obtained directly from Colquhoun (coincides within 1 percent with the population for year 1800 from Maddison, 2001).

Urbanization rate: Estimated from Allen (2003, Figure 9, p. 428).

Mean income in $PPP: Maddison (2001) for year 1800.

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France, 1788

Social group	Number of people (in 000)	Percentage of population	Per capita income (livres / annum)	Income in terms of per capita mean
Agricultural day laborers and servants	10150	36.29	39.4	0.27
Small scale farmers	5250	18.77	64.6	0.45
Workers (non agricultural)	1500	5.36	66.7	0.47
Mixed workers	1800	6.44	75.0	0.52
Servants (non agricultural)	1080	3.86	92.6	0.65
Shopkeepers and artisans	3240	11.58	150.0	1.05
Large scale farmers	2250	8.04	219.6	1.53
Bourgeoisie	2160	7.72	724.1	5.05
Nobles and clergy	540	1.93	724.1	5.05
Total	*27970*	*100*	*143.3*	*1*

Income distribution data: From Christian Morrisson and Wayne Snyder (2000). The "high income" variant for income of nobles and clergy and bourgeoisie assumed.

Population and area: Population (27.97 million) obtained directly from Morrisson and Snyder data. The current area of France assumed.

Urbanization rate: From Bairoch (1985, p. 279). The average of the estimated 11-13 percent, for the year 1800, and based on cities with more than 5,000 inhabitants.

Mean income in PPP: GDP from Maddison (2007), for year 1820 (the first year for which the data for France are available) is $1134.

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Holland 1561

Income distribution data: The full distribution data was not reported in the source (van Zanden 1995), from whence we got the Gini coefficient. Unfortunately, but hardly surprisingly, the author was not able to recover the data from his pre-electronic, and 15 year old files. In personal correspondence (October 2007), however, Jan Luiten van Zanden provided additional information of use to us, expanding on his 1995 results (particularly those contained on pages 650-652).

Population and area: Population is interpolated between 1514 (276,000) and 1622 (677,00) based on de Vries and van der Woude (1997, Table 3.1, p. 52). We assume that the modern area of Holland applied to 1561.

Urbanization rate: From van Bavel and van Zanden (2004); urban definition not offered.

Mean income in $PPP: GDP per capita in 1990 international dollars interpolated between 1500 and 1600, from Maddison (2001: p. 264).

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Holland 1732

Consolidated income group	Weighted number of households	Percentage of population	Per capita income (in guilder per annum)	Income in terms of per capita mean
1	220	7.11	5	0.07
2	192	6.20	6	0.09
3	472	15.25	15	0.22
4	292	9.42	24	0.35
5	336.75	10.88	25	0.37
6	277.125	8.95	35	0.52
7	144.125	4.66	45	0.66
8	277	8.96	48	0.71
9	75.125	2.43	55	0.81
10	42.375	1.37	65	0.96
11	176	5.70	72	1.06
12	31.5	1.02	75	1.11
13	23.25	0.75	85	1.25
14	27	0.87	95	1.40
15	77	2.48	96	1.42
16	26.75	0.86	110	1.62
17	56	1.82	120	1.77
18	23.5	0.76	130	1.92
19	32	1.05	144	2.12
20	24.75	0.80	150	2.21
21	17	0.54	168	2.48
22	11.25	0.36	170	2.51
23	16.125	0.52	190	2.80
24	19	0.62	192	2.83
25	10	0.31	216	3.19
26	26.25	0.85	225	3.32
27	10	0.31	240	3.54
28	5	0.16	264	3.89
29	25	0.81	275	4.06
30	2	0.08	288	4.25
31	17.25	0.56	325	4.79
32	11.75	0.38	375	5.53
33	12.625	0.41	425	6.27
34	30	0.97	450	6.64
35	12.5	0.40	475	7.01
36	5.5	0.18	525	7.74
37	5.125	0.17	575	8.48
38	4.625	0.15	625	9.22
39	4.75	0.15	675	9.95
40	5.5	0.18	750	11.06
41	5.625	0.18	850	12.54
42	3.875	0.13	950	14.01
43	4	0.13	1150	16.96

Consolidated income group	Weighted number of households	Percentage of population	Per capita income (in guilder per annum)	Income in terms of per capita mean
44	1.75	0.06	1400	20.65
45	1.75	0.06	1750	25.81
46	0.25	0.01	2250	33.18
Total	*3095*	*100*	*67..8*	*1*

Income distribution data: The income distribution data are derived from taxes on dwelling rents. The rental values of all dwellings (including the poor) were taxed. We know that dwelling rents were highly correlated with income (Williamson 1985; van den Berg and van Zanden, 1988: pp. 193-215), but we also know that the elasticity of rents to income was less than one (between 0.72 and 0.75 in 1852-1910 Britain: Williamson 1985, p. 225). Thus, income inequality should be understated by rental values. With that understood, the source of the Dutch data is van Zanden (1995).

The consolidated Holland data for 1732 are obtained as a weighted average of distributions of household income for five regions: Amsterdam (with the weight of 25 percent), Delft (12.5 percent), countryside (37.5 percent), townships (12.5 percent) and Leiden (12.5 percent). The first four regions have the same income groups (with income ranges varying between 5 and 2250 guilders). Leiden's distribution has different income ranges, going from 6 to over 400 guilders. The data in the table give a consolidated all-Holland distribution. The data for five regions were kindly provided by Jan Luiten van Zanden.

Population and area: Based on de Vries and van der Woude (1997, Table 3.1, p. 52) who for the period around 1750 give the population of 783,000, and on personal communication by Luiten van Zanden (December 10, 2007). We use the area of modern Holland (21,680 km^2).

Urbanization rate: From de Vries (1985).

Mean income in $PPP: GDP per capita in 1990 international dollars interpolated between 1500 and 1600, and between 1700 and 1820, from Maddison (2001: p. 264).

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India–at the end of the Moghul rule (around 1750)

Social group	Percentage of population	Percentage of total income	Income in terms of per capita mean
Tribal economy	10	3	0.3
Nobility, zamindars	1	15	15
Merchants to sweepers	17	37	2.2
Village economy	72	45	0.6
Total	*100*	*100*	*1*

India–at the end of the British rule (1947)

Social group	Percentage of population	Percentage of total income	Income in terms of per capita mean
Landless peasants	17	4	0.2
Tribal economy	7	2	0.3
Sharecroppers, tenants	29	12	0.4
Working land proprietors	20	18	0.9
Petty traders, govt. & industrial workers	17	30	1.8
Village renters	9	20	2.2
Nobility, Indian capitalists	0.94	9	9.6
British officials, traders	0.06	5	83.3
Total	*100*	*100*	*1*

Note: Zamindars were large landowners. The data refer to the entire Indian subcontinent (today's India, Pakistan and Bangladesh).

Income distribution data: The source of both data sets is Maddison (2002), which in turn are based on Maddison (1971: pp. 33 and 69). Maddison (2002) gives only population and income shares, but if we combine this information with Maddison's own estimates of GDI per capita for India (see below), we can calculate $PPP income estimates for each social group. Indian Moghul data present a particular problem because there are only 4 social classes given. Since their incomes are vastly different, and the largest group (72 percent; village economy) is in the middle of income distribution, probably spanning people with very different incomes, Gini2 is unusually some 27 percent higher than the minimum Gini (G2 is 48.9 vs. Gini minimum 38.5).[1]

Discussion: Note that a part (but only a part) of high Indian inequality around the time of the independence from Great Britain is caused by very high incomes of the British in India. According to Maddison, 0.06 percent of the population (British officials and businessmen) received 5 percent of total income which made their average per capita

[1] For the definitions of G1 and G2, see the main text.

income more than $PPP 51,000 per year (and would place them in the top 5 percent of today's US income distribution). Yet, despite these incomes being extravagantly high, this is only a part of the story since the Gini without the British is still at a rather high level of 45 (as opposed to 48-49 with them). Consequently, the main cause of the very high inequality is a very low income level of the poor classes.

One can also compare the without-the-British inequality in India in 1947 to the inequality results derived from the first Indian National Sample Survey (NSS) conducted in 1951. The expenditure-based NSS Gini is only 36.[2] So—(1) are expenditures significantly more equally distributed, compared to income, than we would expect (a conventional adjustment, suggested by Li, Squire and Zou (1998), is 5 to 6 Gini points while here the difference is 9 Gini points),[3] or (2) is Maddison overestimating India's 1947 inequality; or (3) is he underestimating income of India's poor, or (4) did inequality go down by several Gini points between the end of the British *raj* and 1951?

Population and area: The Indian population in 1750 is estimated from Maddison (2003: appendix HS-8, Table 8a, p. 256). Interpolation based on the data for 1700 and 1820. The population for 1947 is taken directly from Maddison (2003). For both dates, the area includes the entire Indian subcontinent (today's India, Pakistan and Bangladesh).

Urbanization rate: For 1750, from Bergier and Matthieu (2002: Table 1, original sources given there). Obtained by interpolation from the urbanization rates of the Indian subcontinent of 11-13 % in 1700 and 9-12% in 1800. These latter rates are as given in Bairoch (1985, p. 513). For 1947, obtained as interpolation between the urbanization rate of 14.1% in 1941 and 17.6% in 1951 (Mohan, 1985: Table 1, p. 621). As a corroboration, for 1940, Bairoch (1985, p. 513) gives a range between 14 and 16 percent.

Mean income in $PPP: From Maddison (2004). For around 1750, we assume the same income as in 1820 (the first year in Maddison's series). For 1947, the value is taken directly from Maddison (2004).

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[2] See WIDER data set available at http://www.wider.unu.edu/wiid/wiid.htm, available also at http://econ.worldbank.org/projects/inequality (all the Ginis dataset).

[3] And it could easily be argued that the difference ought to be less since data from social tables are very rough in that they assign the same income to an entire class of people and do not allow for the fact that some people from a mean-poorer class may have higher incomes than some people from a mean-richer class.

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Java 1880

Income class	Number of households	Percentage of households	Estimated per capita income (in florins per annum)	Income in terms of per capita mean
1	222483	5.55	50	0.31
2	465614	11.62	75	0.46
3	1279911	31.95	100	0.61
4	815395	20.36	120	0.74
5	723228	18.05	150	0.92
6	67728	1.69	200	1.23
7	207309	5.18	250	1.54
8	57247	1.43	300	1.84
9	80568	2.01	500	3.07
10	35668	0.89	750	4.61
11	21702	0.54	1000	6.14
12	15059	0.38	1500	9.21
13	1757	0.04	2000	12.29
14	4370	0.11	2500	15.36
15	385	0.01	3000	18.43
16	1579	0.04	4000	24.57
17	3383	0.08	5000	30.71
18	1035	0.03	7500	46.07
19	574	0.01	10000	61.43
20	268	0.01	15000	92.14
21	76	0.002	20000	122.85
22	196	0.005	25000	153.57
23	139	0.003	35000	214.99
24	46	0.001	50000	307.13
25	20	0.000	75000	460.70
26	21	0.001	100000	614.27
27	8	0.000	150000	921.40
28	4	0.000	200000	1228.53
29	2	0.000	250000	1535.67
30	1	0.000	350000	2149.93
31	1	0.000	500000	3071.33
32	1	0.000	1000000	6142.67
Total	*4005778*	*100*	*162.80*	*1*

Income distribution data: The sources and methods for the Java 1880 estimates are described in Jan Luiten van Zanden (2003, Appendix A).

Population and area: Indonesian population from Maddison (2007). Java population for 1880 assumed to stand in the same proportion to total Indonesian population as in 1924 (62 percent). The area of the island of Java is 126,700 km^2.

Urbanization rate: Urbanization in Java 1880 from van Zanden (2003, p. 18). Based on cities larger than 10,000 people.

Mean income in PPP: GDP per capita for the entire Indonesia in 1918 ($PPP 909); from Maddison (2007).

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Java 1924

Social group	Number of people	Percentage of population	Per capita income (in guilders per annum)	Income in terms of per capita mean
Sharecroppers	1,161,886	3.30	24.89	0.52
Agricultural laborers	4,217,247	11.99	29.01	0.60
Small landowners	9,262,391	26.34	29.51	0.61
Coolies	7,373,979	20.97	31.32	0.65
Medium landowners	6,775,218	19.26	48.93	1.01
Artisans and small traders	2,388,629	6.79	57.14	1.18
Religious officials	147,158	0.42	62.99	1.31
Workers in European & Chinese enterprises	1,240,296	3.53	81.18	1.68
Village officials	938,005	2.67	96.81	2.01
Large landowners	850,561	2.42	130.38	2.70
Civil servants	515,159	1.46	153.95	3.19
Large traders; factory owners	113,642	0.32	188.14	3.90
Asiatic foreigners	124,807	0.35	282.40	5.85
Europeans	61,648	0.18	2,042.40	42.33
Total	35,170,626	*100*	*43.9*	*1*

Income distribution data: From Booth (1988, Table 7, p. 325). In the original, the data are only for native Javan population and given for three areas: distributions of the same social groups with their average household per capita income in rural areas, towns and cities. Cities include Batavia, Meester Correlius, Bandung, Semarang and Surabaya. Based on a 1924 survey of 1,020 native Javan households reported in J. W. Meijer Ranneft and W. Huender (1926, p.10). Data as shown here are consolidated for the entire Java. The data for European and Asiatic foreigners are from a separate source: *Koloniaal Verslag, 1922/23-1923/24*, *Statistisch Jaaroverzicht voor Nederlandsch-Indië, 1922-30, Indisch Verslag, 1931-40*: vol. VII, pp. 118-19, pointed out by Pierre van der Eng, who also provided the European (2.72) and the Asian foreigner (3.8) average family size estimates.

Population and area: According to the census, the total population of Java and Madura on December 31, 1927 was estimated at 34,984,171 people. The source is Division of Commerce, *1930 Handbook of the Netherlands East Indies*, Buitenzorg, Java: Department of Agriculture, Industry and Commerce, 1930, p. 57. This source includes only non-foreign population, but the sources and evidence cited in the paragraph above imply a foreign share of 0.53 percent. (No doubt that share was higher in Java where the main cities were located.) Total population of 35,170,626 used here includes foreigners. The area of the island of Java is 126,700 km^2.

Urbanization rate: Estimated at 3 percent by van Valkenberg (1925).

Mean income in PPP: GDP per capita for Indonesia 1918 ($PPP 909); from Maddison (2007).

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Japan 1886

Income distribution data: Income distribution data not available. Gini from Moriguchi and Saez (2005, table F2-Hist Gini) available at http://elsa.berkeley.edu/~saez/. For the year 1886, there are two estimates: Gini of 34.5 from Otsuki and Takamatsu (1978) and a higher one of 39.5 from Minami (1995a and 1995b, Table 6-4, Series I & II). These two values are taken to be respectively our Gini1 and Gini2. The years 1884-86 are the first years when income distribution data are available for Japan (see Moriguchi and Saez 2005, page 6, footnote 7).

Population and area: Population from Moriguchi and Saez (2005, Table 1). Current area of Japan assumed.

Urbanization rate: From Bairoch (1985, p. 465) estimate for around 1850.

Mean income in PPP: From Maddison (2007).

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Kenya 1914

Social group	Number of people (in 000)	Percentage of population	Per capita income (in shillings per annum)	Income in terms of per capita mean
African small holders	3404.7	89.15	30.0	0.66
African self employed	18.6	0.49	48.1	1.06
African agricultural wage earners	201.2	5.27	64.1	1.40
African non-agricultural private sector employees	122.6	3.21	123.0	2.69
African non-agricultural public sector employees	49.4	1.29	123.0	2.69
Asian agricultural wage earners	0.4	0.01	746.5	16.36
Asian non-agricultural private sector employees	6.8	0.18	897.3	19.66
Asian non-agricultural public sector employees	5.6	0.15	897.3	19.66
Asian self employed	2.0	0.05	1327.0	29.08
European non-agricultural private sector employees	0.5	0.01	2794.8	61.24
European non-agricultural public sector employees	1.9	0.05	2794.8	61.24
European agricultural wage earners	0.7	0.02	2976.3	65.22
European self employed	1.4	0.04	10344.8	226.69
Total	*3815.7*	*100*	*45.6*	*1*

Income distribution data: From Bigston (1987): Table VI.2, p. 51; Table VI.4.1, p. 53; and Table VIC.3, p. 152. See also Bigston (1986). Implied family size is the reciprocal of the labor participation rate. Transcribed and processed by Jeffrey G. Williamson, June 2008, from materials sent by Arne Bigston.

Population and area: Population from Bigston (1987). The current area of Kenya.

Urbanization rate: The Africa-wide average for 1920 given in Bairoch (1986; Table 26.1, p. 561).

Mean income in PPP: Income of the poorest social class (89 percent of the population) assumed to be at the subsistence ($PPP 300). The mean income in $PPP then derived as the ratio of local currency mean to local currency income of the poorest group times $300. This yields $PPP 456.

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Bigston, Arne (1987), *Income Distribution and Growth in a Dual Economy: Kenya 1914-1976*, Gothenburg University, Department of Economics, Memorandum No. 101 (1987): Table VI.2, p. 51; Table VI.4.1, p. 53; and Table VIC.3, p. 152.

Kenya 1927

Social group	Number of people (in 000)	Percentage of population	Per capita income (in shillings per annum)	Income in terms of per capita mean
African small holders	3220.0	82.10	137	0.57
African agricultural wage earners	288.0	7.34	211	0.87
African self employed	48.8	1.24	271	1.12
African non-agricultural private sector employees	223.5	5.70	373	1.54
African non-agricultural public sector employees	96.8	2.47	373	1.54
Asian agricultural wage earners	1.0	0.03	2368	9.79
Asian non-agricultural private sector employees	9.8	0.25	2620	10.83
Asian non-agricultural public sector employees	7.8	0.20	2620	10.83
Asian self employed	13.1	0.33	4400	18.18
European agricultural wage earners	2.2	0.06	8421	34.80
European non-agricultural private sector employees	3.8	0.10	9316	38.50
European non-agricultural public sector employees	3.6	0.09	9316	38.50
European self employed	3.8	0.10	32094	132.64
Total	*3922.1*	*100*	*242*	*1*

Income distribution data: From Bigston (1987): Table VI.2, p. 51; Table VI.4.1, p. 53; and Table VIC.3, p. 152. See also Bigston (1986). Implied family size is the reciprocal of the labor participation rate. Transcribed and processed by Jeffrey G. Williamson, June 2008, from materials sent by Arne Bigston.

Population and area: Population from Bigston (1987). The current area of Kenya.

Urbanization rate: The Africa-wide average for 1930 given in Bairoch (1986; Table 26.1, p. 561).

Mean income in PPP: Income of the poorest social class (82 percent of the population) assumed to be at the subsistence ($PPP 300). The mean income in $PPP then derived as the ratio of local currency mean to local currency income of the poorest group times $300. This yields $PPP 558.

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Bigston, Arne (1987), *Income Distribution and Growth in a Dual Economy: Kenya 1914-1976*, Gothenburg University, Department of Economics, Memorandum No. 101 (1987): Table VI.2, p. 51; Table VI.4.1, p. 53; and Table VIC.3, p. 152.

Levant, province ("liva") of Damascus, 1596

Income decile	Percentage of population	Average per capita income (in *akches* per annum)	Income in terms of per capita mean
1	10	159.64	0.19
2	10	317.88	0.38
3	10	415.19	0.49
4	10	502.66	0.60
5	10	579.19	0.69
6	10	702.08	0.83
7	10	838.78	0.99
8	10	1035.86	1.23
9	10	1345.31	1.59
10	10	2562.69	3.03
Total	*100*	*844.78*	*1*

Income distribution data: The data source is a tax census of rural settlements conducted by the Ottoman authorities. The data were processed, analyzed and kindly supplied by Metin Cosgel. The description of Ottoman tax censuses, *Tahrir Defterleri*, can be found in Cosgel (2004, 2006).

Monetary amount of taxes is calculated using the data on quantities (in physical units) that are paid as in-kind taxes multiplied by the administrative prices of barley and wheat (per local unit) as listed by the enumerators. This amount is then divided by the statutory tax rate on these products to yield estimated total output in monetary terms. (Total tax is higher than these two statutory tax rates because it includes also other flat taxes (e.g. tax on meadows) which are not directly linked to output.) For example, in Levant, the tax rate on wheat and barley ranged between 25 and 40 percent with a mode of 30 percent. Since the tax rates varied between the areas and settlements, enumerators would often indicate what tax rate applied in a particular case (see for example Cosgel, 2004, p.337). [4]

The data cover only rural areas and people who were paying taxes there. They do not include Ottoman landlords who were exempt from taxation. There are no data on urban areas because the tax data from urban areas are very fragmentary -- as many people did not pay taxes at all: soldiers, government officials, etc. -- and as the tax rates varied for unknown reasons. In other words, Cosgel's estimates of rural incomes are constructed essentially from tax data and using the fact that the tax rate applied in rural areas was more or less observed by the authorities. But the rules for cities varied between different

[4] Cosgel provides also two additional very similar surveys, from Western Anatolia (region of Bursa) for the year 1573, and Southern Hungary, for the years 1562-1570. The methodology of derivation of estimated incomes per settlement is the same but the regional prices of wheat and barley are different (region specific). The use of these different grain prices by region implies that one cannot directly compare total incomes between the three regions. That is, the within-regional analysis is possible, but not inter-regional analysis. The urbanization rates of these two regions however are much higher than that of Levant, and hence a rural based survey would be much less representative of the entire area.

occupations, and Cosgel believes that the rules were never firm even legally, and were applied often arbitrarily. City people were often government officials who also were not subject to taxes, and other professions like traders and artisans seem to have used their proximity to the rulers to ask for favors.

Population and area: Included is the province of Damascus which consists of 7 districts (Ajlun, Gaza, Lajjun, Nablus, Qada Hawran, Quds (Jerusalem) and Safad). Cosgel defines the areas as "Ottoman Palestine, Transjordan, and Southern Syria." Area (26,250 km^2) estimated from the detailed map of the region. Total number of settlements included in the survey is 1415; total number of households included in the survey is 47,405. Some 10 percent of household at most might have been omitted from the census (private communication from Metin Cosgel, March 26, 2008). Assuming an average number of 5 members per households (estimate provided by Metin Cosgel; same communication) gives an estimated total population of about 263,000.

Urbanization rate: Estimated by Metin Cosgel at 11.6 percent (personal communication). The population cut-off point for cities is not clear.

Mean income in $PPP: Obtained as the ratio between the overall mean income from the survey (169.3 akcha per capita) and the estimated subsistence minimum (52.2 akcha per capita) with the latter priced at $PPP 300. The average income is thus $PPP 974. The subsistence minimum is calculated as follows. Food minimum is taken to require consumption of 200 kg of wheat per person per year (data from the Byzantine diet; see Milanovic 2006; also Allen's 'bare bones subsistence basket' containing 172 kg of wheat (quoted in Scheidel, 2008, Table 2, p.8)).[5] The cost of that quantity is 42.9 akcha, based on per bushel average price of 5.83 akcha (average regional contemporary price) [6] and the standard conversion of the volume measure of bushels into kilograms of wheat (with 7.35 bushels holding 200 kg of wheat).[7] This cost of 42.9 akchas is multiplied by 1.9 to get to total subsistence minimum (accounting for other food; the other food to wheat ratio being taken from Milanovic 2006) and then by 3.2 equivalent adults to get the subsistence minimum for an average five-member household.[8] This yields 257 akchas per family of five, which is then divided by 5 to get the subsistence estimate of 52.2 akcha per capita. (Based on personal communications with Metin Cosgel).

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[5] Average per capita consumption in Rome, in the early Empire, is given around 300 kg per year (see Kessler and Temin, 2007, p. 315). The estimate seems to come from Garnsey (1998).
[6] The bushel prices within the seven districts varied between 5 and 6.7 akchas per bushel. We take the simple average of these (5.83 akchas).
[7] The Ottoman or more exactly the Istanbul bushel (*kile*) is almost exactly the same as the US bushel, both equal to 0.97 UK bushel.
[8] Using the contemporary OECD equivalence scale, a family of two adults and three children would imply 3.2 adult equivalent units.

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Naples, Kingdom of, 1811

Income Class	Percentage of population	Income per family (in ducats)	Income per capita (in ducats per annum)	Income in terms of per capita mean
1	10	200	38	0.58
2	10	230	44	0.67
3	10	260	50	0.75
4	10	260	50	0.75
5	10	260	50	0.75
6	10	260	50	0.75
7	10	260	50	0.75
8	10	260	50	0.75
9	10	260	50	0.75
10	6	600	114	1.74
11	3.3	1500	286	4.34
12	0.7	5000	952	14.47
Total	*100*		*65.8*	*1*

Note: Average household size (5.25) assumed to be the same across all income groups

Income distribution data: The source is Malanima (2006: p. 31), who uses the tax census data from 1811. This tax census is, for the purposes of establishing an estimate of income distribution, better than others because it surveyed not only tax paying units but also the poor (the indigent). Each of the 14 provinces of the Kingdom was supposed to place people in predetermined nine categories, running from the poorest to the richest (by family income). The percentage of people placed in each category was "free" (that is, left to each village, city etc.) with the only stipulation that not more than one-sixth of the population may be placed in the bottom category (the "indigent") and hence be exempt from taxation. The problem is that it imposes an equality of conditions across provinces and leads to an underestimation of incomes in the rich areas like Naples-city. For example, people with a same income may be placed in category III in Naples and in higher category IV in a poorer province. Similarly, the number of poor in Naples (which was probably high) might have been underestimated (because of the imposed threshold of one-sixth). Yet, with the exception of the Naples-city (then the third largest European city containing about 6 percent of the total Kingdom's population), which also displayed relatively high inequality,[9] income differences between the provinces were too small to lead to significant and systematic misplacing of households. The ratio of mean rural incomes between the richest and poorest province was less than 1.5 to 1 (and rural population accounted for 85% of the total population).[10]

Another problem is that the authorities in each province might have been tempted to underestimate people's incomes and to push more people into lower classes so that taxes would be minimized. This is reflected in the fact that some 75 percent of families were

[9] The Gini given by Malanima (2006) is 53.

[10] Excluding Naples-city, the same ratio for the urban areas is even narrower: 1.4 to 1 (calculated from Malanima).

grouped in the second class (just above the indigent; see Malanima 2006, Table 3, p. 9).[11] Malanima, however, revised these original data, used information about salaries and other sources of income, and constructed a new distribution (which we use here) composed of nine groups, each consisting of 10 percent of the population, and the top decile divided into three groups (see Malanima 2006: Appendix). We thus obtain an income distribution composed of twelve groups ranked by their estimated per capita income.

Population and area: Malanima (2006: p.3).

Urbanization rate: Malanima (2006: Table 7, p. 15)

Mean income in $PPP: Obtained as the ratio between the mean income of the Kingdom of Naples as calculated from Malanima data (65.8 ducats per capita per annum) and the subsistence minimum (31 ducats per capita for a five-member family in rural areas). Mean income is thus 2.1 times the subsistence. Taking $PPP 300 for the subsistence, results in mean income of $PPP 637. This can be contrasted with Maddison's (2004) estimate of Italy's 1820 GDI per capita of $PPP 1117. Since Kingdom of Naples was poorer than most of Italy (north of Naples), the difference seems plausible.

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[11] It is notable, however, that the quota for the indigent which was 16.6 percent was not fulfilled: in total, only 14.4 percent of families were placed in this group and thus tax-exempt.

Netherlands 1808

Income Class	Number of households	Percentage of households	Average income in florins	Income in terms of per capita mean
1	173440	46.9	100	0.31
2	45414	12.3	150	0.47
3	38998	10.5	200	0.63
4	26816	7.3	240	0.75
5	16799	4.5	300	0.94
6	18959	5.1	400	1.25
7	9841	2.7	500	1.57
8	13806	3.7	600	1.88
9	7398	2.0	1000	3.13
10	7735	2.1	1500	4.70
11	5842	1.6	2000	6.26
12	1349	0.4	3000	9.39
13	1506	0.4	4000	12.53
14	749	0.2	5000	15.66
15	445	0.1	6000	18.79
16	385	0.1	8000	25.05
17	211	0.1	10000	31.31
18	82	0.0	15000	46.97
19	8	0.0	20000	62.63
20	4	0.0	30000	93.94
Total	*369787*	*100*	*319.34*	*1*

Income distribution data: Personal communication from Jan-Luiten van Zanden; expansion on the data set provided in Soltow and van Zanden (1998, Chapter 6). The income estimates based on housing rents. See also the explanation provided for Holland 1732.

Population and area: Population is interpolated between 1700 and 1820 (2,002,783) from Maddison (2001). The area is for today's Netherlands (41,865 square km).

Urbanization rate: From de Vries (2000, Table 1, p. 454). The rate is given for year 1815.

Mean income in PPP: Maddison's (2007) 1820 value ($PPP1837) reduced to $PPP1800 because of the war.

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Nueva España 1790

Social group	Percentage of population	Annual income per family (pesos)	Annual income per capita (pesos)	Income in terms of per capita mean
Indigenous peasant class	72	61	12.2	0.24
Mestizo middle class	18	300	60	1.19
Spanish upper class	10	1,543	309	6.12
Total	*100*	*252*	*50.4*	*1*

Note: Assumed household size = 5 for all social groups.

Income distribution data: In 1813, Manuel Abad y Queipo, Bishop of Michoacán, published his *Colección*. His social tables offer information on: family size, total population, three income classes with population shares and income per capita for the bottom two (the Spanish upper class 10%, mestizo middle class 18% at 60 pesos, and indigenous peasant class 72% at 12.2 pesos). What is missing to complete the crude size distribution is either an estimate of average income per capita for the richest class or an estimate of total income for Nueva España as a whole. Our estimates use an average of the latter from three sources: Coatsworth's 240 million pesos in 1800 (Coatsworth 1978 and 1989); Rosenzweig's 190 million pesos in 1810 (Rosenzweig Hernández 1989); and TePaske's 251 million pesos in 1806 (TePaske 1985).

Population and area: Population estimate of 4,500,000 from *Colección* (1813). Modern Mexican borders are used to define the area of 1,224,433 km^2 since it appears that Manuel Abad y Queipo ignored New Mexico and California.

Urbanization rate: Calculated from cities with 10,000 or more inhabitants from von Humboldt (1822).

Mean income in $PPP: 1800 GDP per capita in 1990 international dollars (Coatsworth 2003 and 2005).

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Old Castille (Spain) 1752

Province	Families surveyed	Estimated population	Annual income per family (in pesos)	Income per capita (in pesos per annum)	Income in terms of per capita mean
Villarramiel	94	376	250	62.5	0.26
Villarramiel	146	584	750	187.5	0.77
Villarramiel	58	232	1250	312.5	1.28
Villarramiel	38	152	1750	437.5	1.79
Villarramiel	19	76	2250	562.5	2.31
Villarramiel	8	32	2750	687.5	2.82
Villarramiel	6	24	3250	812.5	3.33
Villarramiel	1	4	3750	937.5	3.84
Villarramiel	8	32	5677	1419.25	5.82
Paredes	364	1456	250	62.5	0.26
Paredes	395	1580	750	187.5	0.77
Paredes	68	272	1250	312.5	1.28
Paredes	21	84	1750	437.5	1.79
Paredes	17	68	2250	562.5	2.31
Paredes	6	24	2750	687.5	2.82
Paredes	8	32	3250	812.5	3.33
Paredes	5	20	3750	937.5	3.84
Paredes	39	156	5677	1419.25	5.82
Palencia	943	3772	250	62.5	0.26
Palencia	483	1932	750	187.5	0.77
Palencia	219	876	1250	312.5	1.28
Palencia	101	404	1750	437.5	1.79
Palencia	56	224	2250	562.5	2.31
Palencia	28	112	2750	687.5	2.82
Palencia	36	144	3250	812.5	3.33
Palencia	19	76	3750	937.5	3.84
Palencia	89	356	5677	1419.25	5.82
Frechilla	56	224	68	16.9325	0.07
Frechilla	67	268	437	109.1875	0.45
Frechilla	89	356	594	148.615	0.61
Frechilla	34	136	866	216.4775	0.89
Frechilla	26	104	1223	305.8175	1.25
Frechilla	18	72	1810	452.4175	1.85
Frechilla	25	100	2460	614.97	2.52
Frechilla	8	32	3513	878.25	3.60
Frechilla	5	20	4351	1087.7	4.46
Frechilla	6	24	5546	1386.543	5.68
Frechilla	1	4	6918	1729.5	7.09
Frechilla	5	20	7325	1831.15	7.51
Frechilla	3	12	9975	2493.75	10.22
Villalpando	87	348	213	53.20402	0.22
Villalpando	106	424	341	85.1309	0.35
Villalpando	46	184	610	152.3859	0.62

Province	Families surveyed	Estimated population	Annual income per family (in pesos)	Income per capita (in pesos per annum)	Income in terms of per capita mean
Villalpando	21	84	832	208.0357	0.85
Villalpando	27	108	1247	311.7407	1.28
Villalpando	5	20	1683	420.8	1.73
Villalpando	17	68	2568	641.9559	2.63
Villalpando	8	32	3559	889.8438	3.65
Villalpando	2	8	4757	1189.125	4.87
Villalpando	5	20	5509	1377.15	5.65
Villalpando	3	12	6569	1642.333	6.73
Total	*3945*	*15780*	*975.72*	*243.94*	*1*

Note: People (and families) ranked by per capita income within each province. Total gives the overall (Old Castille) mean. Family size assumed to be 4 throughout.

Income distribution data: Family annual income estimates (in pesos) from five locations in the Palencia region, part of what is now Castilla y León: Frechilla (13 income classes) and Villalpando (11 income classes); Palencia city, Paredes de Nava, and Villarramiel (9 income classes each). These data were kindly provided by Leandro Prados de la Escosura, who used them recently in Álvarez-Nogal and Prados de la Escosura (2006), which in turn were taken from Yun Casalilla (1987: p. 465) and Ramos Palencia (2001: p. 70). The data used here are based on the consolidation of income distribution data from the five regions.

Population and area: Population of 1,980,000 and area of 89,061 km^2 are from Lees and Hohenberg (1989: pp. 443 and 445)

Urbanization rate: The 1750 estimate from Lees and Hohenberg (1989: p. 443).

Mean income in $PPP: GDP per capita for Spain, in 1990 international dollars interpolated between 1700 and 1820, from Maddison (2001: p. 264).

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Peru 1876

Social group	Number of people	Percentage of people	Per capita income (soles per annum)	Income in terms of per capita mean
Female spinners	167778	12.8	59	0.33
Low paying female occupations	166785	12.7	97	0.54
Farmers (both sexes)	513277	39.2	117	0.65
Male laborers	276447	21.1	146	0.81
Poorer artisans-provinces	70757	5.4	269	1.49
Other earners	84432	6.5	312	1.73
Poorer artisans-Lima	5620	0.4	832	4.61
Govt salaried people	9728	0.7	970	5.38
"Patentees"	13670	1.04	3670	20.35
Total	*1308494*	*100*	*180*	*1*

Income distribution data: Shane Hunt's estimates as revised by Albert Berry (1990, Table 4, p. 47). Barry's "high inequality" revision are used here.

Population and area: The area of modern Peru. Population from "Population annual historical data" available at http://www.populstat.info/Americas/peruc.htlm.

Urbanization rate: An estimate based on Bairoch's (1985, Table 26/3, p. 542) data for Latin America in 1850 and 1900.

Mean income in PPP: Maddison (2007) value for the year 1900 (the first year for which data for Peru are available).

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Roman Empire 14

Social group	Number of members	People	Percentage of population	Average family income (in HS)	Average per capita income (in HS)	Income in terms of per capita mean
Senators 1/	600	2470	0.004	150000	37975	100
Knights (equestrian order) 1/	40000	158000	0.285	30000	7595	20
Municipal senators (decurions) 1/	360000	1422000	2.562	8000	2025	5.3
Other rich people	200000	790000	1.423		4810	12.7
Legion commanders 2/	50	198	0.000	67670	17132	45.1
Centurions	2500	9875	0.018	16160	4091	10.8
Praetorians 3/	9000	35550	0.064	3000	759	2.0
Ordinary soldiers 4/	250000	987500	1.8	1010	256	0.7
Workers at average wage 5/	1066667	4213333	7.6	800	304	0.8
Tradesmen and service workers 6/	133333	526667	0.9		468	1.2
Farmers and farm workers (free or slave) 7/	12000000	47400000	85.4		234	0.6
Memo: Subsistence minimum 8/					180	0.47
Total		*55,500,000*	*100.0*		*380*	*1.0*

Note: The average household size of 3.95 (derived from Goldsmith, 1984) used throughout except for senators where the average household size (on account of many dependents) was increased to 4.1. HS = sestertius.
For explanation of the notes, see text below.

Income distribution data: The basis for calculations is provided by Goldsmith's (1984, pp. 276-278) estimates. Goldsmith provides minimum wealth (census qualification) for the three top classes (senators, knights and municipal senators), an estimate of their mean incomes, and an estimate of their population sizes. The problem was that –taking these estimates as given, and assuming that the bulk of the working population lived at slightly above the subsistence minimum ($PPP 300)—one finds an overall lower mean income than given by Goldsmith and used here (HS 380). This is why we introduced, following Goldsmith who spoke of that class but did not put any numbers on it, a fourth rich class of "other rich people" who were neither Roman knights nor municipal senators (both of which needed to fulfill the census requirements). There is little doubt that that "fourth" rich class existed but putting a number on its size and average income is obviously difficult. We decided to take as their mean income the average of the two other higher classes' incomes (leaving out as decidedly the richest the class of Roman senators). [12]

There is a lively argument on how "graduated" was economic class structure of the Empire and whether one can speak of an *economic* middle class (a position we implicitly take here). In a recent contribution, Scheidel (2006, p.54) argues: "I conclude that there is sufficient evidence in support of the notion of an economic continuum from a narrow elite to a steadily broadening middle class as we move down the resource ladder…It is perfectly possible to reconcile the dominance of a disproportionately affluent elite with the presence of a substantial middle class". Note finally that if one takes the position in favor of the existence of a middle class, then –to be consistent—the estimates of average income in early Empire must be reasonably high in order for such a class to exist at a level significantly above the subsistence. Temin's estimates of Roman income (discussed below) would not allow that. [13]

The total number of *honestiores* (the top three classes with families) was, according to Goldstein, about 2.8 percent of the population. Scheidel (2007, p. 41-42) however believes that they numbered just over 1 percent. The difference revolves around the number of municipal senators, assumed to number 360,000 by Goldstein. In order for Scheidel 1 percent to hold, their numbers should be around one-third of it. But it is very difficult to see how that can be reconciled with Jongman (1988), approvingly quoted by Scheidel (2006, p. 42, n. 6) who estimates that Italy alone had at least 90,000 city councilors.

<u>*Notes to the table above*</u>

1/ From Goldsmith (1984, pp. 276-278). Total amount for senators includes HS15 million of Augustus' and Imperial household's (100 people) private fortune. The censuses, according to Goldsmith, were 1 million for senators and 250,000 for the knights. According to Finlay (1985, p. 46) and Kessler and Temin (2007, p. 317), the census for

[12] Maddison (2008, pp. 48-9), noticing the same discrepancy, reduced the total nunber of municipal senators (*decurions*) from 360,000 to 240,000.

[13] Scheidel (2006) does not seem to realize this fully in his proposed calculations of social structure.

the knights was 400,000 HS. The difference seems to be accounted for by the broader inclusion (definition) of knights by Goldsmith: according to him, the number of knights was 40,000 (the value kept here), according to Kessler and Temin (2007, p. 317) only 5,000. The average annual income of senators' class is calculated to be 15 percent of the census (note: census is the *threshold*) and for knights, 12 percent of the census amount. The average income of municipal senators is from Goldsmith (p. 278) and represents an average of census requirements and estimated average income of municipal senators in diverse (from large and rich, to small and poor) cities.

2/ The legion's commander wage ratio (67 times ordinary soldier's wage) is given in Duncan-Jones (p. 116) who quotes Brunt (1950). The number of legion commanders calculated by dividing 250,000 soldiers by the average size of a legion (5,000 men; for the average size of the legion, see Duncan-Jones p. 215 and Tacitus, *Histories*, Penguin Classics, pp. 226 and 322).

3/ Clark (p. 676). The size of the Praetorian guard was 9 cohorts each with 1,000 men.

4/ Calculated from Clark (p. 676): 225 denarii (1 denarius = 4 HS) *plus* 50 modii of wheat valued at 110 HS (Milanovic, 2006, Table 3). This assumes the average wheat price 2.2 HS per modius. Harl (p. 276) gives modius wheat price range from 8 asses (2 HS) in Egypt to 32 (8 HS) in Rome. Temin (2006, p. 138) gives free market price in Rome at 4-6 HS; Kessler and Temin (2007, p. 317, fn) around 6HS per modium. After the huge Rome's fire in 64, Tacitus (Book XV, Chapter 39) mentions that the price of wheat in Rome, due to the sudden impoverishment of the population, dropped to 3HS per modius. We select a relatively low price to avoid inflating incomes by using Roman prices for the goods that were essentially consumed outside the capital.

Tacitus (Book I, Chapter 17) quotes soldiers (in year 14) complaining that a soldier is worth only 10 asses per day. That would be 2.5 HS per day or 912 HS per annum, some 10 percent below our estimate of HS 1010. Tacitus' number almost certainly refers to the monetary pay only, *i.e.*, it excludes payments in kind.

Size of the army (250,000) from Temin (2006, p. 147) quoting Goodman (1997). Similarly, Walbank (p.19) gives 250-300,000.

5/ Based on Goldsmith (3.5 HS per day times 225 working days). Temin (2006, p. 138) gives also the average wage in Rome as 3-4 HS per day (see also Milanovic, 2006, Table 4 and the sources given there). Wages expressed at Rome-city prices (see discussion of mean income below). Workers are estimated to account for 80 percent of the urban population.

6/ From Temin (2006, p. 136). We assume that their income was twice the subsistence. They are assumed to account for 10 percent of the urban population.

7/ The lowest class according to Temin (2006). It includes both free laborers and slaves. We assume their average income to be 30% above the subsistence minimum. They account for more than 90 percent of the rural population (which in turn accounts for 90 percent of the total population). According to Evans (1981), quoted in Geraghty (2007, p. 1041), an average plebeian family of 4 produced grain worth about 1000 HS. That would give a per capita income of 250 HS from grain alone. They are likely to have had other sources of income, pushing their income somewhat higher. Farm workers (slave or free) had about the same income although slaves appear to have worked harder than free workers (250 vs. 150 days per annum on average; see Geraghty, 2007, p. 1040, fn. 21; based on Spurr, 1986).

Maddison (2008, pp. 47-50) distinguishes between free and slave labor using Scheidel's (1997) estimates for both the number of slaves and their annual number of workdays. For workers at average wage, he takes Goldsmith's estimate (as we do here too). For slaves, he assumes that their average income was 300 HS per annum and that they had only 0.25 dependents per person. This works out as 240 HS per capita, very close to our estimate of 234 HS.

The bottom line is that we have 93 percent of the population (workers, and farmers and farm workers) living on household income less than HS 800 (equal to the average wage) while that number reaches almost 97 percent in Maddison (2008). The difference is due to Maddison's disregards of the army in his calculations.

8/ From Milanovic (2006, Table 4), based on Goldsmith (1984, p. 268) and the amount of *alimenta* paid from the public treasury to boys under 15 years of age. Duncan-Jones (1982) gives a slightly different amount (16HS per month) for boys, and 10 HS per months for girls (quoted from Geraghty (2007, p. 1046, fn. 52).

Discussion.
(1) Slaves and landowners. Slaves are not shown as a separate social category. This is because their economic conditions covered practically the entire spectrum of incomes (with a possible exception of the very top). Their consumption levels varied widely: they ranged from being very rich (owning slaves themselves) to being very poor (mostly slaves engaged in mining). Even rural slaves, who were on average worse-off than urban slaves, were not just "all undifferentiated gang laborers; [on the contrary] there are lists of rural slave jobs that are as varied as the known range of urban or household slave jobs" (Temin, no date, p. 8). For the urban slaves, who were more numerous than rural slaves, [14] the prevalence of manumission made Roman slavery (unlike that in the Americas) an "open slavery". Schiavone (2000) and Temin (no date) discuss the position of slaves and the role of manumission at great length. Similarly, landowners are not shown separately as a class since most landowners belonged to the four top classes and their incomes from land are included in our totals.

(2) Top of the income distribution. The estimated Gini of between 37 and 40 might seem low in light of the excesses of wealth in Rome (see Table below with data gathered from Tacitus's *Annals*) But this extraordinary wealth was limited to a very few people at the

[14] According to Schiavone (2000, p.112), slaves represented 35 percent or more of Italy's population. And Italy was the most urbanized part of the Empire.

very top. It is very unlikely that they would be even selected (so few they were) to participate in a modern random household survey. Moreover, their extraordinary wealth was not out of step with what we observe today. For example, the fabulously rich triumvir Marcus Crassus (-115 to -53) whose wealth was estimated at 200 million HS (Schiavone, 2000, p.71) and hence his income at HS 12 million per year,[15] has more than a counterpart in today's Bill Gates and other super rich. Crassus's income was equal to about 32,000 mean Roman incomes. Using today's US GDI per capita, the equivalent would be an income of about $1 billion per year. But this is an income that is easily made by many of today's hyper-billionaires and yet the overall inequality is not much affected by it. Bill Gates's fortune is estimated at $50 billion which with 6% interest yields $3 billion per year, i.e., three times as much as Crassus. According to The *Forbes' Magazine* 2007 list of richest people in the world,[16] four individuals in the United States have wealth above $20 billion, which would place them around Crassus's level.

Other incomes and wages compiled from Tacitus' *Annals* and *Histories* (for comparison and illustrative purposes):

	Amounts in HS	Amounts in terms of the estimated average annual income (or GDP)	Source
From *Annals*			
Augustus' donative to each pretorian guardsman (year 14)	1000	2.6	Book I, Chapter 8
Augustus' donative to each legionnaire and soldier of cohorts (year 14)	300	0.8	Book I, Chapter 8
Augustus' donative to people (year 14)	43.5 million	0.2% of GDP	Book I, Chapter 8
Tiberius dowry to Agrippa's daughter (year 19)	1 million	~2600	Book II, Chapter 86
Left by the Senate to Senator Marcus Piso after his punishment (year 20)	5 million	~13,000 (or 5 times the senatorial census)	Book III, Chapter 17
Tiberius' personal loan to the banks (who were suffering from shortage of funds; year 33)	100 million	0.5% of GDP	Book VI, Chapter 25
Tiberius' donative after a large fire in Rome (year 36)	100 million	0.5% of GDP	Book VI, Chapter 51
Maximal lawyer's fee (year 47)	10,000	26	Book XI, Chapter 7
Consular reward for raising a pertinent issue in the senate (paid to a senator; year 52)	5 million	5 times the senatorial census	Book XII, Chapter 53

[15] Using the conventional interest rate of 6 percent (see Finley, 1985, p.104).
[16] Available at http://www.forbes.com/lists/2007/10/07billionaires_The-Worlds-Billionaires-North-America_6Rank.html.

Nero's guaranteed annual income for Messala (year 58)	500,000	~1300	Book XIII, Chapter 34
Seneca's average annual earnings (years 55-58)	75,000	~200	Book XIII, Chapter 42
Nero's average annual gift to the state treasury (year 61)	60 million	~0.3% of GDP	Book XV, Chapter 18
Nero's subsidy to each soldier after they crushed Piso's conspiracy (year 65)	2,000	5.2	Book XV, Chapter 72
Nero's gift to Lyon (Lugdunum) after a big fire (year 65)	4 million	~0.02% of GDP	Book XVI, Chapter 13
From *Histories* (year 69)			
Nero's total largesse (donatives during his rule, 54-68)	2.2 billion	~10% of GDP	Book I, 20
Tip to each member of a cohort whenever Galba (the emperor) dined	100	0.26	Book I, 24
General's bounty to each soldier	300	0.8	Book I, 66
Emperor's gift to troops after a seeming revolt	5,000	~13	Book I, 82
Vitellius (the short-lived emperor squanders money on banquets and debauch in a few months)	900 million	~4% of GDP	Book II, 95
A social climber's spoils during Nero's rule	7 million		Book IV, 42
State loan floated for public subscription in 69	60 million	~0.3% of GDP	Book IV, 47

Note: Augustus's donatives refer to the amounts given out at his death.
Inflation rate was estimated by Temin (2003, p. 149) to have been less than 1 percent per annum, up to the end of the Julio-Claudian era in 69. Thus, later (post-Augustan) incomes ought to be deflated accordingly.

(3) Top-to-bottom spread. Following Jongman (1988), Geraghty (2007, p. 1051) writes: "Indeed, the average senator generated 200 times more income than a peasant's subsistence wages in the early Imperium". Our numbers show this ratio to be 210.

Population and area: Population is taken from Goldsmith (1984: p. 263). Goldsmith also gives the area as 3.3 million km^2, while Taagepera (1979: Table 2, p. 125) gives 3.4 million km^2 (for year 1, wrongly labeled as year 0).

Urbanization rate: Goldsmith's (1984: pp. 272-3) range is 9 to 13 percent with the former number "nearer the lower boundary at the beginning of the principate." (The urbanization rate seems to have been calculated based on the cut-off point of 2-3,000 people). In addition to Rome, the population of which is conventionally estimated at 1 million (Bairoch 1985: p. 115), there were six cities (Carthage, Alexandria, Antioch, Ephesus, Pergamum and Apamea) with the populations in excess of 100,000 (Schiavone 2000: p. 61). Taking their average size to be 150,000, it follows that about 2 million (or almost 4 percent of the population) lived in the cities that were larger than 100,000. For the urbanization rate, we use a median estimate of 10 percent. For Augustan Italy, the richest and most urbanized region of the Empire, the urbanization rate is estimated at about 27 percent (1.2 million urban residents out of a population of 4.4 million (see Geraghty (2007, p. 1044, fn. 39, and p. 1048) and the references given there).[17]

Mean income in $PPP: Obtained by expressing mean income from Goldsmith (HS 380) in terms of the subsistence minimum (estimated at HS 180), and then pricing the latter at $PPP 300. This yields mean income of $PPP 633 in 1990 prices. In his most recent "Contours of the World Economy, 1-2003 AD" (2008; Chapter 1) Maddison gives disposable per capita income for the Empire in year 14 as $PPP 570. His approach in deriving this average is rather peculiar: it is obtained as an average of Roman incomes expressed in gold and wheat compared with 1688 purchasing power of English incomes in terms of wheat and gold (Maddison, 2008, p. 52).

Discussion
Temin (2003) argues that Goldsmith's calculation of the mean Roman income is too high. However, there are at least three counterarguments to Temin: (1) his critique of Goldsmith's calculations is not based on Goldsmith's methodology (which Temin praises) but on Goldsmith's apparent use of Rome-based wage rates for the rest of the Empire including Egypt where both wheat prices and wages were much lower in nominal terms. Temin then uses an average of the two nominal wage-rates, and obtains a significantly lower overall Imperial mean income. But that issue can be sidestepped by arguing that the Imperial numbers are expressed in Rome-city prices. This is acceptable since Temin (2003, p. 19) himself believes that *real* (wheat) wages in Egypt and Rome-city were about the same. Thus, Temin's methodology of averaging two nominal wage-rates seems faulty. (2) The level of infrastructural development, urbanization, size of a large standing army (almost ½ of a percent of total population), and the point made by Schiavone (2000) that regional differences in mean incomes might have been as high as 5 or even 6 to 1,[18] imply that an overall Imperial mean income was unlikely to have been less than HS 380 (as calculated by Goldsmith) which, using the assumptions regarding the subsistence minimum, translates into about $PPP 633 (in 1990 prices). (3) There is the consistency argument against changing Goldsmith's mean income while retaining all his other calculations.

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[17] And, as today, the richest part was in the North: "…the forces of Vitellius now controlled the most prosperous area of Italy, including all the flat country and the cities between Po and the Alps" (Tacitus, *Histories*, Book II, Chapter 17).

[18] If there are large inter-regional differences, and even the poorest region is at the subsistence, then the overall Imperial mean must be relatively high. Large regional differences are mentioned by Goldsmith too (1984: p. 265).

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South Serbia 1455

Income deciles	Percentage of population	Average per capita income (in *akchas* per month)	Income in terms of per capita mean
1	10	49.45	0.54
2	10	66.38	0.72
3	10	72.13	0.79
4	10	75.95	0.83
5	10	80.41	0.88
6	10	86.70	0.95
7	10	92.94	1.01
8	10	99.77	1.09
9	10	114.70	1.25
10	10	181.57	1.98
Total	*100*	*91.59*	*1*

Income distribution data: The results are based on a detailed census conducted by the Ottoman authorities soon after the conquest of a part of Southern Serbia (a region which is smaller and contained within the territory of the currently disputed province of Kosovo). The census data were supposed to provide information about wealth, income and hence taxes to be paid by the Christian subjects (Muslims were exempt from the poll tax). In addition, household characteristics were included in order to gather information about the possible Army recruits. The results of the census (*defter* in Turkish[19]) whose original is kept in the Imperial archives in Istanbul have been pieces together (over some 20 years) translated and published in Serbian in a massive book edited by Miloš Macura (2001) of which economic data—used here—represent only a small fraction (see pages 107-118). (The book is much more focused on geography, demographic movements and ethnic composition.) The data are presented as mean incomes for each settlement (village), of which there are almost 700. So, this represents a fairly large set of numbers but there are two drawbacks—in addition to the usual one, namely that we do not know how reliable the original estimates are, nor how good are the imputations of different in-kind incomes made by the authors of the book. First, the survey leaves out the top class of Turkish military leaders and landowners which was quite small (the region was conquered merely a few years earlier) but also rich, with extensive land holdings. Second, the village-level means conceal some variation between the households. The second element is probably small because of the general evenness of conditions of the conquered peasantry, but the first element imparts an obvious downward bias to inequality statistics. The income distribution table above summarizes the data by showing mean income per capita for the ten deciles of settlements (weighted by population). This means that all inhabitants of a settlement are supposed to have the same per capita income but settlements of different sizes are weighted appropriately.

[19] See also the explanation given in the section on Levant.

Population and area: Total population is estimated at between 75 and 90 thousand (Macura 2001: pp. 20 and 25). Area is from Macura (2001: p. 79).

Urbanization rate: Very low since all settlements (with the exception of one) are tiny hamlets and villages. The Ottoman conquest was followed by a rapid decline in population and de-urbanization. It is estimated that between 1385 and 1455 population of the Brankovina region decreased by about a third, and the largest regional town (a mining center of Novo Brdo) became practically deserted. Macura does not provide an estimate, but based on his discussion, the urbanization rate of the whole area, of which the survey covers only a part, was around 2 or 3 percent.

Mean income in $PPP: Mean income in terms of the subsistence minimum obtained as the ratio between the average per capita income from the census (91.6 akchas per month) and the estimated subsistence minimum of 62 akchas. The subsistence minimum is assumed to be one-half of a monthly Ottoman unskilled construction worker's daily wage (4.77 akchas) as reported by Pamuk (2001) for the period 1460-1500.[20] Using the amount of $PPP 300 for the subsistence minimum, the ratio of 1.48 (91.6/62) translates into $PPP 443.

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[20] Assuming 26 working days in a month.

Siam 1929-1930

Income Class	Number of households	Percentage of households	Average income per capita (*baht* per annum)	Income in terms of per capita mean
1	777455	6.70	5.48	0.18
2	504047	4.34	7.97	0.26
3	297273	2.56	8.36	0.27
4	777455	6.70	8.44	0.28
5	777455	6.70	11.16	0.37
6	504047	4.34	13.14	0.43
7	297273	2.56	13.26	0.43
8	722467	6.22	13.43	0.44
9	777455	6.70	14.87	0.49
10	297273	2.56	17.58	0.58
11	504047	4.34	18.43	0.60
12	722467	6.22	23.23	0.76
13	297273	2.56	24.02	0.79
14	504047	4.34	26.33	0.86
15	777455	6.70	27.77	0.91
16	722467	6.22	32.60	1.07
17	722466	6.22	49.72	1.63
18	297272	2.56	51.95	1.70
19	504047	4.34	83.16	2.73
20	722466	6.22	117.54	3.85
21	101200	0.87	210.56	6.90
Total	*11,607,407*	*100*	*30.42*	*1*

Income distribution data: The income distribution data are taken from an extensive rural survey done in 1930-31 (Zimmerman 1999), which referred to the income period spring 1929 to spring 1930, a fairly normal year prior to the great depression and the fall in rice prices. While it included the province of Bangkok, it did not include the city itself (with a population of 506,000). However, provincial towns were included in the sample, which was reported by four regions (Center, South, North and Northeast) and five quintiles, yielding 20 income classes plus the top officialdom. All incomes are reported in nominal *bhat*. Persons per household were only available as regional averages. Since the original distribution excluded Bangkok, it excluded merchants, artisans and the urban poor. Call these the non-royal Bangkok residents. Having no information on any of these, we have in effect assumed that these economically heterogeneous groups among the non-royal residents replicated their share distribution outside of Bangkok. We do not, however, ignore what we call the "officialdom" (the royal family, bureaucrats, and the church hierarchy) since we know a great deal more about this top Bangkok-located income group. Under the traditional system, officials were entitled to *kin muang*, or "eat the realm" (Zimmerman 1999: vii), that is to receive as income taxes paid by the peasants. Thus, we allocate the reported 21,308,381 in tax revenues (listed by household in the original) to the officialdom, and we estimate that their number was about a fifth of the Bangkok population (101,200 or 18,333 families). This gives us the 21st social class.

Population and area: Population of 11,607,407 from Wilson (1983: 32-34, augmented by the 101,200 officialdom), and the area is 513,115 km^2 (current area of Thailand).

Urbanization rate: The average of 9-11 percent given in Bairoch (1985, p. 522) for year 1930.

Mean income in $PPP: 1929 GDP per capita in 1990 international dollars was 799 (Maddison 1995: 204).

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Tuscany 1427

Income Class	Number of people	Percentage of people	Average income per capita *(florins* per annum)	Income in terms of per capita mean
Lowest decile	3918	10.2	10.90	0.32
Second	3936	10.3	12.99	0.38
Third	3659	9.6	14.59	0.43
Fourth	3937	10.3	16.60	0.48
Fifth	3776	9.9	18.99	0.55
Sixth	3841	10.0	22.26	0.65
Seventh	3750	9.8	26.47	0.77
Eights	3864	10.1	33.44	0.98
Ninth	3796	9.9	47.98	1.40
Top decile	3827	10.0	138.79	4.05
Total	*38304*	*100*	*34.23*	*1*

Income distribution data: The underlying data from the special census of 1427-1429 cover the city of Florence and immediate Tuscan environs, and not the other territories that Florence controlled between the Apennines and the Mediterranean, using data from 1427 only. The data were originally collated in a famous study by David Herlihy and Christiane Klapisch-Zuber (1985). A newer version consists of the downloadable files at the Brown University site http://www.stg.brown.edu / projects / catasto. Peter Lindert later (January 2008) downloaded the same source's data on bocche (persons) and on real estate. We thank Maristella Botticini of Boston University for downloading most of the variables.

The assumptions behind our estimates are inevitably complex, because the catasto return itself is complex.

Herlihy and Klapisch-Zuber (HK) capitalized yearly income estimates to get wealth at the rate of 7 percent. Thus, by taking 7% of wealth as property income, we are reversing their procedure.

Those assets exempted from the assessment included "the family home and its furnishings, and also the tools which supported the taxpayer in productive employment. They [also] gave favorable treatment to plow animals in the countryside and beasts of burden everywhere. They even allowed deductions for the costs of maintaining farm buildings and fertilizing fields." (Herlihy and Klapisch-Zuber 1985, pp. 9-10).

More exemptions: "[E]very citizen of Florence was allowed to subtract 200 florins from his total assets for every family member." (p. 10.) We assume that this did not reduce the stated wealth figures here, and only reduced the taxes paid.

But "no deductions [of 200 florins of wealth, or 14 florins of income] be allowed for the mouths or heads of any salaried person, whether servant, nurse, clerk, employee or apprentice." (Source, as quoted in Herlihy and Klapisch-Zuber 1985, p. 12.)

"By far the largest group of exempt persons was the clergy. From the number of parishes and religious institutions in Tuscany, we would estimate their size at some 7,000 to 8,000" (p. 25.) But this seems to be for all the territories controlled by Florence, not just for the city.

The assessments are apparently of wealth and income, not just taxable wealth and income.

We made three alternative sets of assumptions about income inequality in Florence 1427: TOO-EQUAL = A set of assumptions that with high probability will understate the inequality of income among households (and individuals); PREFERRED = A set of assumptions designed to estimate the median-probability Gini coefficient for incomes; and TOO-UNEQ = A set of assumptions that with high probability will overstate the inequality of income. [In addition, ALL = An assumption common to all three estimates. Such an assumption cannot, of course, be both too-equal and too-unequal at the same time, but it is our belief that the other extreme assumptions succeed in putting bounds on the Gini coefficient.]

Asset incomes:

(1) We accept the Catasto's wealth estimates and its 7% rate of return as accurate. Exceptions are a few cases where the census data on the existence of an asset conflict with its zero valuations, as noted below.

Labor earnings rates:

(2) We matched 26 labor-intensive occupations from the catasto with four skills groups yielding direct wage estimates from other sources. We assumed that ordinary workers earned wages or salaries 260 days a year. For the other, more propertied, classes, we assumed: (2a) The TOO-EQUAL ASSUMPTION: Nobody had a labor income per earner that was higher than the 66 florins a year earned by the average clerk working on the catasto. This seriously under-rates the current earnings of managerial and highly skilled labor. (2b) The PREFERRED ASSUMPTION: For these more propertied classes, labor income = the mid-point between the labor income estimates in (3a) and (3c) below. (2c) TOO-UNEQUAL ASSUMPTION: Labor income = max (14 florins, the value of property income). This assumption denies the fact that incomes from non-human assets like land, bonds, and even commercial property must have soared above the labor earnings in the top quarter of the distribution.

(3) Earnings by non-heads in the household: Charles de la Roncière assumes that the expenditures (and, implicitly, income) of a Florentine worker's family of four people in 1369-1377 was 2.22 times the earnings of a bachelor with the same occupation.

So we assume that each non-head member of a working-class household raised income by 0.407 (=1.22/3) times the unskilled wage rate of 23.1 florins, or 9.4 florins. Such additional labor earnings were probably greater in lower-status households than in more propertied households, but we cannot assume so. Thus: (3a) TOO-EQUAL in TOTAL INCOME: Apply these non-head earnings only to the labor-intensive stated occupations. (3b) PREFERRED: Apply them to the stated labor-intensive occupations and to non-stated occupations, not to high-status. (3c) TOO-UNEQ: Apply these extra earnings to all households.

For a too-equal distribution for income per capita we added (3d) TOO-EQUAL in PER CAPITA: Assume that each non-head in the households with unskilled wage with stated labor-intensive occupations earned 4/5 of the unskilled wage, or 18.48 florins.

Home ownership, for those with occupations given:

(4) ALL: (4a) No adjustment is needed for the income value of owner-occupied housing in cases where the home's value was assessed. This is because the surveyors included such implicit income in their valuations.

We need a different approach for families where no real-estate value is given.

(4b) Where no real-estate value is given and the household does not own its residence (this should be a redundancy, but isn't one in fact), again no adjustment is needed.

(4c) BUT in cases where there is no real-estate value but the household is recorded as owning its home, we must multiply the stated incomes (property plus assumed labor earnings) by $1/(1-\rho)$.

Rho is the share of rental expenditures in total expenditures among households in Florence in 1369-1377 according to de la Roncière. It equals 3.8 percent for bachelors and 6.8 percent for a family of four. We use the 6.8 percent figure for all cases where bocche (persons) ≥ 2.

(4d) Similarly, in 15 percent of cases where the household head either gets housing rent-free or nothing is said about ownership or rent, we multiply by $1/(1-\rho)$.

Rural households (Herlihy and Klapisch-Zuber consider the no-occupation to be heavily rural):

(5a) TOO-EQUAL and PREFERRED estimates: No occupation listed, no cattle, and no home ownership, assume labor earnings = 14 for main earner.

(5b) ALL: No occupation, no cattle, owns home, and has real estate: assume an unskilled wage of 23.1.

(5c) ALL: No occupation, no cattle, owns home, BUT has no recorded real estate: again assume an unskilled wage of 23.1, but in these cases we must multiply total income by 1/(1-rho) because of the implicit value of housing, as in (5c) above.

(6) ALL: No occupation, no home ownership, but owns some beasts or cattle: A pretty rich group. Use 23.1 for the household head's labor income.

(7) No occupation, yes home owned, and owned some beasts and cattle (these tended to have above-average property income):

(7a) Head's income for TOO-EQUAL = 23.1.

(7b) Head's total income for PREFERRED = 23.1 * 1.5.

(7c) Head's total income for TOO-UNEQ = 23.1 * 2.

(8) TOO-UNEQUAL: As with the occupation-stated group,

Labor income = max (14 florins, and 1/4 the value of property income).

This overstates rural inequality, while honoring the likelihood that labor incomes were a much smaller share of high rural incomes than of high urban incomes.

Gini estimates:

Tuscan Gini coefficients (Gini1 = Gini2) for 1427, estimated using the assumptions described above:

	Too-equal (underestimate)	Preferred estimate	Too-unequal (over-estimate)
Gini for total household incomes	53.0	54.9	59.9
Gini for household income per capita	44.0	47.1	50.5

Population and area: Population taken directly from the census. Total number of households in the census is 9,779, and total population (*bocche*) is 38,340. Area from Herlihy and Klapisch-Zuber (1985, p.39).

Urbanization rate: From Herlihy and Klapisch-Zuber (1985, p. 56).

Mean income in $PPP: We took the ratio of average income per capita for Tuscany (34.6 florins) to its subsistence income estimated at 14 florins a year, and applied this ratio (2.47) to the assumed level of subsistence of $PPP300. Back in 1301 "Florence's yearly income was then an estimated 780,000 pounds or roughly 338,000 florins" (Herlihy and Klapisch-Zuber, p. 2). Thus our estimate of 1,287,607 florins for 1427 implies a growth rate of 1.06 percent a year for the combination of average real incomes, population, and price inflation.

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Appendix 2: The w/y Calculations

Observation	Gini mid-range Avereage Gini1 and Gini2	Average Economy Income (y)	Landless Peasant Income (Wr)	Urban Worker Income (Wu)	Wr/y	Wu/y
Rome 14: "workers @ ave. wage" = Wu "farmers & workers (free & slave)" = Wr	37.9	380.0	234.0	304.0	0.62	0.80
Byzantium 1000: "urban marginals" = Wu "tenants" = Wr	41.1	6.2	3.5	3.5	0.56	0.56
England 1688: "laboring people & servants" = Wu "cottagers & paupers" = Wr	45.0	9.6	2.0	4.3	0.21	0.45
England 1759: "laborers, London" = Wu "laborers, country" = Wr	45.9	43.4	16.0	28.0	0.37	0.65
England 1801-3: "laborers in mines & canals" = Wu, "laborers in husbandry" = Wr	51.4	90.5	31.0	40.0	0.34	0.44
Naples 1811: "income classes 3-9" = Wu "income class 2" = Wr	28.3	65.8	44.0	50.0	0.67	0.75
India 1750: "village economy" = Wr	43.7				0.60	
India 1947: "landless peasants" = Wr	48.9				0.20	
Brazil 1872: male day laborers in agriculture = Wr	41.0	312.0	212.0		0.67	
China 1880: "commoners" = Wr	24.2	6.5	4.9		0.76	
Old Castille 1752: "Palencia city, three lowest classes" = Wu, "four rural districts, two lowest classes" = Wr	52.4	975.7	491.0	530.0	0.50	0.54
Nueva Espana 1790: "indigenous peasant" = Wr	63.5	252.0	61.0		0.24	
Kenya 1914: "African small holders" = Wr	33.2	119.0	81.0	na	0.68	na
Kenya 1927: "African small holders" = Wr	43.9	247.2	137.0	na	0.55	na

Sources: Ginis are the average of Actual Gini1 and Actual Gini2 from Table 2. Average economy incomes are from Appendix 1. Wr and Wu are from Appendix 1, as defined.

Appendix 3: Derivation of the top 1 percent income share

Define H(y) = cumulative percentage of people with incomes higher than *y* (the reverse of the normal distribution that cumulates people from the bottom income upwards).

Also H(y) follows a Pareto distribution:

(1) $H(y) = Ay^{-a}$

where *a*=Pareto exponent. If we do not have individual-level data but income distribution tables with grouped data (fractiles of income distribution), then *y* should ideally be the lower bound of the income interval. There are two differences between these requirements and the data we have. First, we have only social classes arranged by their mean incomes and population shares. In other words, we have percentages of people with an *average* income and do not know lower or upper bounds of their income ranges. Notice that the same problem exists when the data are arranged in deciles and only mean income by decile is available. Second, there are very likely “leakages”--namely people from lower (mean-poorer) social groups whose actual incomes are higher and should be part of the top (and the reverse). This problem is specific to the type of data we have here. These two departures of our data from the usual way income distribution statistics are displayed (even in grouped form) should be kept in mind.

Now, let us define G(y) = total income of those with incomes above *y* divided by total population; if it follows a Pareto distribution, then

(2) $G(y) = \frac{a}{a-1} Ay^{-(a-1)}$

Also, by definition, y_h = mean income of people with income greater than *y*, and

$$G(y) = \frac{y_h H(y) N}{N}$$

This means

(3) $y_h = \frac{G(y)N}{H(y)N} = \frac{G(y)}{H(y)} = \frac{a}{a-1}\frac{A}{y^{a-1}}\frac{y^a}{A} = \frac{a}{a-1}y$

For example, if the Pareto constant is 2, then mean income of those with income greater than *y*, will be 2*y*.

Using (1) and (2), we can link G(y) and H(y):

(4) $G(y) = \frac{a}{a-1} A y^{-(a-1)} = \frac{a}{a-1} A y^{-a} y = \frac{a}{a-1} H(y) y$

Write the expression (4) to the exponent *a*:

$$(G(y))^a = \left(\frac{a}{a-1}\right)^a H^a y^a = \frac{a}{a-1} H^a \frac{A}{H} = KoH^{a-1}$$

where Ko = constant, and we use expression (1).

Now this means that

$$a \ln G = \ln K_0 + (a-1)\ln H = K + (a-1)\ln H$$

where the constant K=ln Ko. Then,

$$\ln H = \frac{a}{a-1} \ln G + C$$

The ratio between the change in H and change in G is:

(5) $\frac{\ln H1 - \ln H2}{\ln G1 - \ln G2} = \frac{(a/a-1)\ln G1 - (a/a-1)\ln G2}{\ln G1 - \ln G2} = \frac{a}{a-1}$

Expression (5) is the key relationship that we fit in order to get the Pareto constant and to interpolate for the values that we do not have in the original data. For example, in the case of Rome we have H1=1.71 and H2=0.29. Now, the H1 people receive 24.4 percent of total income. And H2 people receive 6.2 percent of total income. The top 1 percent receive the share that is between the two.

Using (2) we find that the share of total income received by people whose income is greater than *y*, s(y), is equal to:

(6) $s(y) = \frac{G(y)N}{\mu N} = \frac{G(y)}{\mu}$

where μ=overall mean income.

We can then transform (5)

(7) $\frac{\ln H1 - \ln H2}{\ln G1 - \ln G2} = \frac{\ln H1 - \ln H2}{\ln s1 + \ln \mu - \ln s2 - \ln \mu} = \frac{\ln H1 - \ln H2}{\ln s1 - \ln s2} = \frac{a}{a-1}$

(7) will be the key relationship when we do the estimation. Thus,

$$\frac{\ln 1.71 - \ln 0.29}{\ln 24.4 - \ln 6.2} = \frac{0.536 - (-1.238)}{3.195 - 1.825} = \frac{1.774}{1.37} = 1.295$$

From which we find α=4.38.

Now, to find the income share of the top 1 percent, we use (7) again.

$$\frac{\ln 1.71 - \ln 1}{\ln 24.4 - \ln x} = 1.295$$

$$\frac{0.536}{3.195 - \ln x} = 1.295$$

And thus x=16.13.

We obtain the same result if we do:

$$\frac{\ln 1 - \ln 0.29}{\ln x - \ln 6.2} = 1.295.$$

Note that the data we have here are: (i) the bottom cut-off point (*y*), the share of people above that income level, H(y), and (iii) the share of total income they receive, s(y). The cut-off point is crucial. If we have only the means (for each fractile) and the percentage of people, we are effectively treating the fractile means as the bottom cut off points.

We can also get the important relationship between the income share and the number of people above the income level *y*. Using (4) and (6), we get

$$s(y)\mu = \frac{a}{a-1} H(y) y \qquad \text{and}$$

$$s(y) = \frac{a}{a-1} H(y) \frac{y}{\mu}$$

If H(y)=1 percent, then s(y)=(a/a-1)(y/μ), where *y* is the cut-off point above which the top 1 percent of the population begins, and μ=overall mean. The ratio y/μ expresses, in terms of the overall mean, income level where the top 1 percent of population begins (the 1 percent cut-off point). Going back to the Roman example where we found α=4.38 and s(y)=16.13, we can readily see that this implies a cut-off point of 12.4.

Appendix 4: Sensitivity of the extraction ratio results to different Gini adjustments

	Measured Gini with Deltas' adjustment			Measured Gini + ½ standard error			Measured Gini + 1 standard error		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
GDI per capita	-29.01** (0.03)	-9.10 (0.43)	-9.18 (0.45)	-34.73*** (0.004)	-16.84* (0.09)	-16.99 (0.10)	-45.72*** (0.002)	-26.12** (0.04)	-26.24** (0.05)
Urbanization rate	0.87 (0.12)	0.25 (0.59)	0.23 (0.63)	0.98* (0.08)	0.33 (0.46)	0.37 (0.45)	1.06 (0.11)	0.35 (0.53)	0.389 (0.53)
Population density		-0.26*** (0.001)	-0.24* (0.09)		-0.21*** (0.001)	-0.24* (0.07)		-0.23*** (0.003)	-0.26 (0.11)
Colony (0-1)	24.86** (0.02)	37.82*** (0)	38.54*** (0)	15.40* (0.07)	26.30*** (0.001)	26.30*** (0.002)	14.95 (0.13)	26.89*** (0.005)	27.01*** (0.008)
Dno_foreign (0-1)	-41.32** (0.02)	-60.54*** (0)	-61.04*** (0)	-34.75** (0.01)	-50.36*** (0)	-50.68*** (0)	-44.67*** (0.01)	-61.78*** (0)	-62.24*** (0)
Constant	260.30 (0.004)	144.30 (0.06)	144.52 (0.07)	300.78 (0)	195.99 (0.003)	197.36 (0.005)	383.23 (0)	268.37 (0.002)	269.67 (0.003)
No of obs Adjusted R^2	28 0.34	28 0.59	26 0.56	26 0.45	26 0.68	24 0.64	26 0.50	26 0.67	24 0.63

Note: Both GDI per capita are in natural logs. Coefficients significant at 10, 5 and 1 percent level denoted by respectively one, two and three asterisks. *p* values between brackets.