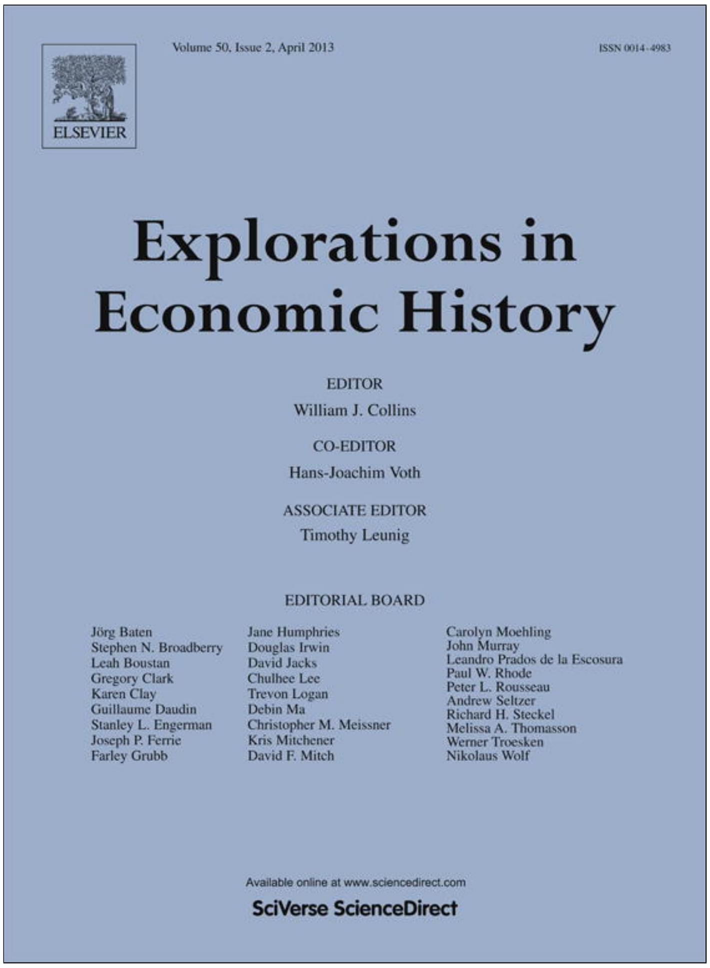
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Inequality and school funding in the rural United States, 1890[☆]

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ABSTRACT

This paper examines the relationship of inequality to school funding in counties of the U.S. in 1890. Inequality, measured here on the basis of farm-size distributions, is found to be negatively related to local school property tax revenues across the whole sample of 1345 rural counties. However, further analysis shows that this relationship is not consistent across the sample. In the North, there is a significant negative relationship between inequality and school funding, and this relationship is shown to be consistent with the fact that assessed values of property did not rise linearly with wealth. Across the South, there is no distinct relationship between inequality and school funding. The results also indicate that inequality in the South cannot directly explain the gap in school funding with the North, in the sense that redistributing farms in the South to match the Northern distributions leads to no predicted increase in school funding.

1. Introduction

The industrialization and modernization of the American economy between the middle of the 19th century and the Great Depression coincide with what has been called by John J. Wallis "The Era of Property Finance and Municipal Government" (Wallis, 2000, 2001). Public provision of education and infrastructure was an integral element of the rapid development experienced in this era. However, the level of funding, for education in particular, was not uniform across the country. In 1890, combined state and local school tax revenues were as low as $0.08 per person in several counties in Georgia, while at the same time many counties in states like Iowa, Kansas, and Wisconsin collected over $5.00 per person for education.[1]

Tax revenues in the late 19th century U.S. were provided mainly by the general property tax. In 1890 almost 72% of state revenues and 92% of local government revenues came from these taxes.[2] Some of the difference in observed school tax revenues per capita is due to differences in the tax base–property values per capita. Even so, a significant portion of the variation in tax revenue per capita is due to differences in the effective tax rate. While there are problems that will be discussed below regarding

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[1] Author's calculations from U.S. Census *Wealth, Debt, and Taxation* (1895).

[2] Author's calculations from U.S. Census *Wealth, Debt, and Taxation* (1895). "Local" includes all county, city, municipal, school district, and other sub-state level jurisdictions.

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the measurement of property value, school tax revenues as a percent of assessed property values varied from less than 0.2% in many parts of the South to greater than 1.5% parts of the Old Northwest.[3]

The aim of this paper is to examine the relationship that inequality had with local property tax revenues in 1890, specifically those levied directly for school funding. The property tax was typically meant to be equally levied against the total wealth of individuals, including not just real estate but financial wealth and personal property.[4] Thus the distribution of this wealth within a political unit (counties, in this paper) was potentially important in determining the tax rate.

In addition to the distribution of wealth, the nature of the assessment process was significant in determining school funding. Several sources are reviewed that reveal a tendency for the assessment rate to decline with the wealth of individuals, thus lowering the effective tax rate on wealthier individuals. This complicates the analysis, and I show that it can result in a non-monotonic relationship between inequality and school taxation, which suggests that the empirical work looks not only at the overall sample but also at sub-samples that can reveal the various relationships.

With these interactions in mind, county level data from the U.S. Census special report on *Wealth, Debt, and Taxation* of 1895 is obtained for property tax revenues, assessed property values, and an imputed value of real estate values. As individual wealth data is not available from 1890, farm size distribution data from the Agricultural Census is the basis for the measurement of inequality. Several adjustments to this data are made, and the sample is limited to rural counties only, to account for the fact that the farm size data excludes both non-farm wealth and information on farm values.

From a sample of 1345 rural counties, several results emerge. Inequality had a negative relationship with the tax revenues of local school districts across all counties. This holds under all the different specifications of inequality and is robust to the potential issues involved in competitive under-assessment of property values between counties. In terms of size, an increase in the Gini coefficient for land inequality of 0.16 (roughly the same as moving from the 25th to the 75th percentile) was associated with a drop in local school revenues per capita in these rural counties of nearly $0.28, a relatively large difference given that mean taxes per capita were $1.33.[5]

This overall negative relationship, though, masks a differential effect between regions of the U.S. Only across the North does this negative relationship arise, and for the South there is an insignificant positive relationship between inequality and school funding. Looking further, this arises because the underlying relationship between farm size and support for school funding is different within the two regions. Across the Northern counties, support for education rises as the proportion of very small farms (those with 0–49 acres) and the proportion of large farms (those with 100–999 acres) rise relative to the proportion of medium-sized farms (50–99 acres). This is consistent with the presence of declining assessment rates, as those at the top end of the wealth distribution face low enough taxes that they support education. In addition, as inequality (as measured by a Gini coefficient) is declining in the share of large farms, this generates the negative relationship between the Gini and school funding seen in the North.

For the South, evidence of significant effects of the farm size distribution on school spending does not exist. As the underlying distribution of wealth is not related to school spending, neither is the Gini.

An additional implication of the empirical results is that overall differences between North and South in school funding were not directly attributable to differences in the farm size distribution. That is, if one were to redistribute farms within the South to match the North's farm size distribution, this would have no predicted effect on the level of school taxation. Low school funding in the South does not appear to be a direct result of inequality.

The differential relationship between inequality and taxation in 1890 adds new information to the literature looking at school funding in the mid-nineteenth and early 20th centuries. Christiana Stoddard (2009) has found that increasing inequality lowered publicly provided education funds in 1850 and 1860, while also showing that these funds significantly raised attendance rates at public schools. Looking at the political economy of this funding, Peter Lindert and Sun Go (2010) document that a wider franchise was associated with greater taxation in support of education as well as enrollments. Einhorn (2001, 2006) has emphasized the incentives of wealthy landowners to limit the property tax in the 19th century.

From the early 20th century, Claudia Goldin (1998) and Goldin and Katz (1997) have proposed that two significant reasons for the variation in the spread of secondary schooling were the level and distribution of wealth. The current results show a similar significant positive effect of property values on school revenues, but provide evidence that inequality and school funding did not have a straightforward negative relationship. The role of inequality appears, from the evidence presented here, to be more subtle in this period just prior to the onset of the secondary school movement in the United States.[6]

The results of this paper also provide more context to the empirical work of Ramcharan (2010), who found a significant negative relationship between inequality and property tax revenues in 1890 at the county level. However, his work did not utilize controls for wealth per capita, nor did it address directly the issue of competitive under-assessment or declining assessment rates. The focus of his paper was on identification, relying on several geographic instruments to control for the endogeneity of the

[3] Author's calculations from the U.S. Census *Wealth, Debt, and Taxation* (1895). The assessed value includes both real and personal property.

[4] Between 1840 and 1900 twenty-two states inserted uniformity provisions into their state constitutions, which added to the five states with existing provisions in force in 1840, see Benson (1965). Einhorn (2001) attributes this movement in part to the motivation of slave-holders to prevent high rates of tax on slaves. The uniformity clauses, in many cases, were enacted alongside incorporation and debt limitation clauses as part of a package of reform to the funding of infrastructure improvements, see Wallis (2005). Similar to uniformity, many states included universality clauses in their constitutions. The main intention of the clauses was to include personal or intangible property (e.g. financial assets and industrial capital) in the tax base alongside realty (e.g. land). Twenty-one states added constitutional provisions for universality into their constitutions between 1840 and 1900, many of them specifically identifying bank notes, money, investments, and personal property as objects of the general property tax, Benson (1965).

[5] The mean value of total school tax revenues per capita, state plus local, was $1.74.

[6] See Goldin and Katz (1997, 2003) and Goldin (2001) on the general features of the U.S. education system.

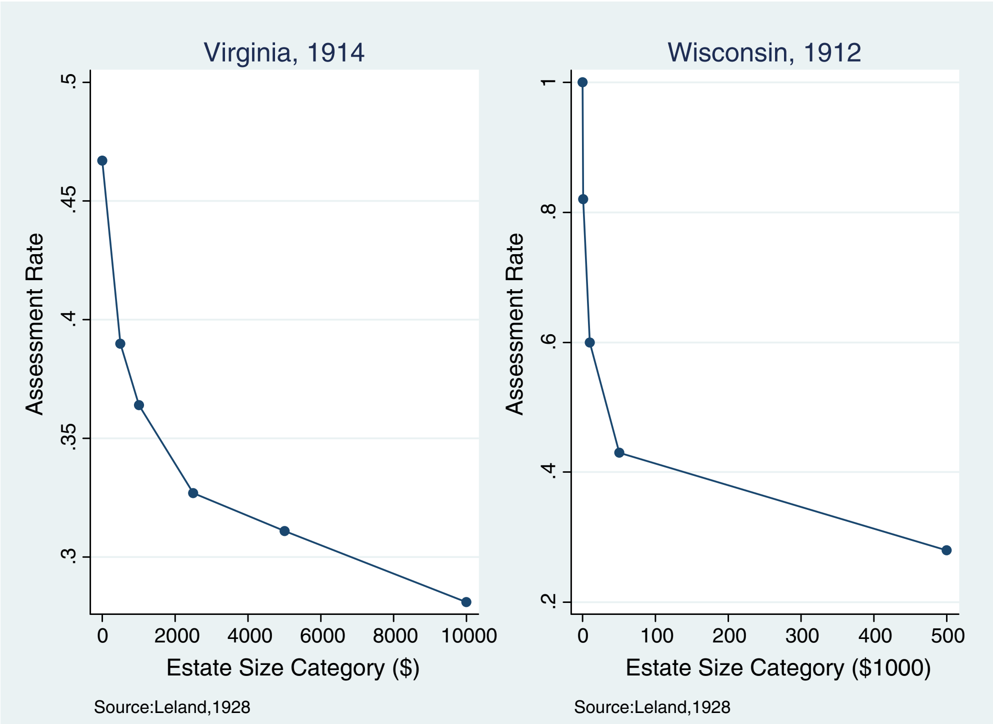

Fig. 1. Assessment rates as a function of estate size.

inequality measures. The non-monotonic relationship of inequality and taxation did not appear in his analysis, due in part to the exclusion wealth per capita controls.

These results also provide information for several broader lines of research. They are complementary to the work of Sokoloff and Zolt (2007) of the distinct differences in taxation levels between countries in the Western Hemisphere, and the association of these differences with initial land inequality. More broadly, the results can provide some insight into current issues in taxation in developing countries that rely on wealth taxation to fund improvements, as discussed by Tanzi (1987) and Burgess and Stern (1993).

2. The relationship of inequality and school taxation

It will be useful to examine some of the particulars of the property tax system in 1890, as these motivate several aspects of the empirical work, including the need to look at sub-samples of counties in different regions as well as drilling down to more detailed farm distribution data.

A commonly cited feature of the general property tax in this era was that it assessed wealthier individuals at a lower rate. Edward Seligman, writing in 1895, argued for the abolition of the property tax, in part because “the property of the small owner, as a rule, is valued by a far higher standard than that of his wealthy neighbor.”[7] More concretely, Simeon Leland (1928) documents that in Wisconsin in 1912, farms valued at under $1000 were assessed at 100s 46.7% for those under $500, but only 28% for those greater than $10,000. Fig. 1 plots the data given by Leland for Wisconsin and Virginia and shows distinctly that the assessment rate is negatively related to estate size. Glenn Fisher (1996, p.116) also provides evidence from Kansas in 1897 of this type of effect. There, farms worth less than $500 were assessed at 56%, while farms over $5000 faced only a 25% assessment rate, and those over $10,000 a rate of 17%. This feature of the property tax system potentially modifies the expected relationship between inequality and school funding, as it changes the tax cost to higher-wealth individuals.

To see how this influences the relationship between wealth and support for education, consider a standard median voter model. Households pay a common tax rate on their assessed wealth. Their assessed wealth increases with actual wealth, but at a decreasing rate, which the above evidence implies. The exact effect of this on support for schooling depends upon how the benefits of education are related to wealth.[8]

This can be seen in Fig. 2, which plots both benefits and taxes against the wealth of households. Empirically, the data available from 1890 allows us to examine wealth from the perspective of farm size, which was a dominant form of personal wealth in rural areas of the period. Further details on the use of farm size data from this period are provided in the following sections, including

[7] Seligman (1969, p. 29).

[8] Standard models, such as those from Alesina and Rodrik (1994) or Epple and Romano (1996), make the assumption that taxes are uniformly applied to all income or wealth. Other variants of the redistributive model include Persson and Tabellini (1994); Glomm and Ravikumar (1992); Saint-Paul and Verdier (1993); Benabou (2000) and Fernandez and Rogerson (1998). Galor et al. (2009) provide a theory of why land inequality, in particular, is detrimental to education funding. All rely on linear tax rates.

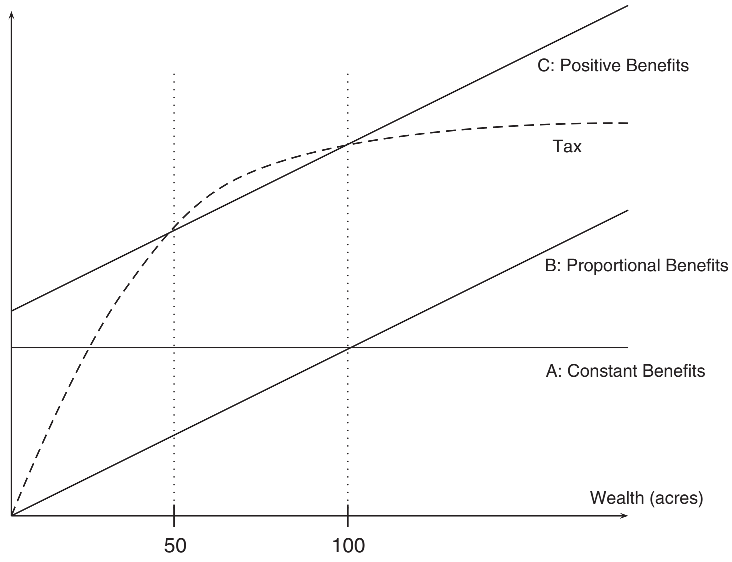

Fig. 2. Support for taxation given benefits, with decreasing assessment rates. *Note*: The dashed line shows taxes paid increasing with wealth, but at a decreasing rate, consistent with the evidence on assessment rates. The solid lines labeled A, B, and C show different possibilities for the benefits from education spending. Support for education taxation depends on the size of benefits compared to tax. In scenario A, only those with less than roughly 25 acres would support taxation. In scenario B, no households would support taxation unless their wealth became greater than that shown in the figure. In scenario C, those with less than 50 acres and those with more than 100 acres both support taxation, but those with 50–100 acres oppose it.

data showing that farm size is a very good proxy for wealth in the rural areas of the United States in 1890. For the moment let household wealth be captured by the acres that a household owns.

The dashed line represents the total tax paid by a household with the declining assessment rate taken into account. The various solid lines are different permutations of the benefits of public schooling and how they vary with wealth. Line *A* represents benefits to education that are constant across all households. As drawn, one can see that households with less than approximately 25 acres will tend to support education, as the benefits outweigh the tax paid. Those with 25 or more acres would be against education. This situation corresponds to a typical median voter model. Raising or lowering this line would change the exact cutoff, but generally speaking support for education falls as wealth increases.

An alternative is that the benefits of education are rising with wealth, perhaps because of the effect on property values. Wallis (2001, 2003) discusses how the property tax was implemented for the reason that those who benefited from the provision of public goods due to increased property values would be those who paid for the public good. The situation represented by line *B* in Fig. 2, which plots the benefits from education spending proportional to wealth, implicitly assumes that there is no additional benefit to education beyond the change in property values (hence the benefits are zero for those with zero wealth). Given how scenario *B* is drawn, all households tend to oppose education. Again, increasing the slope of the benefits curve *B* may alter exactly where support changes, but regardless of how it is drawn, in situation *B* the only possible support for education will come from those at the higher end of the wealth distribution.

Finally, if we assume an increasing benefit from education across wealth, as well as a positive benefit to all households, then benefits would be described by line *C*. In this case, support varies across the wealth distribution non-monotonically. Households with less than 50 acres will tend to support education, as will those with more than 100 acres. However, the middle category of households with 50–99 acres will be opposed to education taxation.[9] Fig. 2 is not meant to imply that any specific scenario *must* hold. The point is that with declining assessment rates the relationship between support for education funding and wealth need not be negative, nor even monotonic.

This motivates several aspects of the empirical work to follow. First, summary inequality measures, such as the Gini, may not be informative about how wealth distribution is related to the funding of public schooling. This arises because the underlying farm size distribution does not necessarily have a consistent relationship with the Gini. Secondly, the implication of the declining assessment rates is that support for education varies across the size categories in a potentially non-monotonic way. Both points can be addressed by looking directly at the underlying wealth distribution data, and so in addition to the Gini I also use measures of the share of farms in different size categories as explanatory variables. These regressions show the source of the relationship between the Gini and school funding, and allow me to distinguish which of the different scenarios posited in Fig. 2 may be relevant. To briefly preview the results, across the North it appears that scenario *C* best fits the data, as the regressions indicate that a greater proportion of farms in the 0–49 acre and 100–999 acre categories (compared to the 50–99 category) is associated with a higher the

[9] A note here is that this effect is exactly opposite of the “ends versus the middle” prediction in Epple and Romano (1996). Their analysis suggests that the middle supports education while the ends oppose it. Here, the implication is that the middle opposes education while the ends show support. Additionally, note that the relationship in Fig. 2 would hold even if the benefits lay everywhere above the tax line, so that all households support education. It would still be the case that those in the 50–99 category supported education *less* than those on the ends.

level of school taxation. In the South, however, there is essentially no difference in local school funding related to the distribution of farms across different size categories, consistent with the importance of state-level funding for education in that region.

To continue, the paper documents the data used for the analysis, making the measurement of school funding more concrete, as well as describing how the data on inequality and farm shares are obtained and related within regions. Following that I turn to regressions that show the relationship of the Gini to education funding, as well as how the individual farm shares are associated with funding, leading to the conclusions described above.

3. Property taxation and wealth distribution in 1890

The practice of property taxation in this period has several features that bear on the analysis in this paper. To begin, the nature of the assessment process worked against the uniform taxation of all property within states. While different levels of government could levy taxes on property, it was local officials who were responsible for making the assessments of property values used by all levels of government. This led to a strategic problem. A county assessor, for example, would under-assess the property in his county in order to minimize the burden of state property taxes. The county, given the low assessment, would simply raise its own tax *rate* in order to meet its funding needs. As this was occurring in each county, a process of competitive under-assessment took place and assessment values within a state would generally be well below the true property value.[10]

The main problem was that the local assessors were not subject to any state control. Glenn Fisher's (1996) study of property taxation in Kansas during this period points out that even if courts declared a specific assessment value illegal, they could do nothing to remedy it. County level boards of equalization were not able to exert much of an influence because they faced the same strategic logic as the assessors, and in addition they typically did not have access to appropriate information.

These problems with competitive under-assessment led to many states implementing state boards of equalization. Massachusetts had a form of state equalization as early as 1694, while several states (Connecticut, Maine, Ohio, Vermont, and Virginia) made sporadic attempts to equalize assessments across counties during the early 1800s. Regular equalization began in the 1850s in several states of the Old Northwest as well as New York. By 1890, 26 states had implemented some form of state equalization.[11]

Despite the spreading prevalence of state equalization, the boards were not able to accomplish much. Fisher reports that in Kansas the state board had only a limited ability to adjust the aggregate value of real estate in a county but had no detailed data on which to make informed decisions.[12] In general, the boards were not able to arrest the process of under-assessment and this is attributed by Harley Lutz (1918, p. 149) to their lack of authority over the local assessors. It is only with the implementation of the state tax commissions, beginning with Indiana in 1891, that states took firmer control of the assessment process.

Empirically, this assessment problem creates several issues. States varied not only in the presence of a state equalization board, but the equalization boards varied across states in their responsibilities and authority in 1890. An advantage of using county level data in the regressions is that state fixed effects can be included, controlling for state level assessment and equalization practices.

The under-assessment process also indicates that looking at state-level taxes may be uninformative. Counties and municipalities, regardless of their preferred local tax rate, would see an advantage in lowering their state tax burden. To examine the effect of the county-level wealth distribution on property taxation, I therefore focus on property taxes levied only at the county and municipal levels.[13] One note is that for convenience I use the term “local” as a catch-all for the combination of county and municipal levels of government.

3.1. Property tax and valuation data

Given that competitive under-assessment will skew the actual tax *rates* applied to assessed property values at the local level, the level of taxation will be measured in the empirical work here by tax revenues per capita, with appropriate controls for wealth per capita included. The 1895 Census report on *Wealth, Debt, and Taxation* provides data on property taxes collected by all levels of government. For each county, the report lists the total tax revenue, as well as breaking this total into several categories based on the taxing authority: state, county, or municipal. A separate accounting is given for taxes collected by the state for education purposes. Addition information is provided on taxes levied within counties for school purposes, which combines taxes levied by the county itself with those levied by municipalities and/or school districts. This total of county, municipal, and school district taxes will be referred to as local school taxes, and will be the measure of school funding used in the empirical work to follow.

To focus on wealth distribution and school taxation, I want to control for the possibility that the wealth distribution and property *values* are related. Holding actual property values per capita constant, any estimated relationship of the distribution to taxes per capita can be interpreted as the relationship of distribution to the effective tax rate applied to property, avoiding the assessment issue.[14] Thus, some measure of actual property values is necessary.

[10] This phenomenon was noted during this period and used by some as an argument against property taxation. See Leland (1928), Lutz (1918), and Seligman (1969).

[11] Lutz (1918). See also the 1895 U.S. Census report on *Wealth, Debt, and Taxation* which summarizes state equalization efforts.

[12] Fisher (1996, p. 113).

[13] This does not imply that state-level taxes are irrelevant, as they would play a part in locality decisions regarding tax rates. As noted below, though, controlling for state tax revenues collected within a county does not appear empirically relevant to local school taxes. Nor does controlling for state school expenditures per county.

[14] This interpretation will be a loose one, though, as there will remain the possibility that inequality is related to the *types* of property in a county. If different types are taxed at different rates, then inequality may lower taxes per capita even though it isn't lowering tax rates per se.

The tax data was obtained by the Census from returns of county and municipal officers involved in the assessment of property values. In addition to the tax data, these officers returned the total assessed value of real estate in their county as well as their opinion of the ratio of the assessed value to the true value of that real estate. As an additional source of data on the true value of real estate, the Census also solicited the opinions of roughly 25,000 persons believed to be experts in real estate values in their respective areas that it used to corroborate the ratios received from the local officials.[15] The value of real estate is calculated in Census report by inflating the assessed value of real estate according to the opinion of the local assessors.

There are several issues with this measure of property values. As noted, this value is based off of estimates from local assessors, and not necessarily on market prices for the real estate. One possible source of better information is the Agricultural Census of 1890, which reports farm values by county. This excludes urban plots of land, though, so it is not an ideal substitute. Regardless, including farm values in the regressions below does not change the results meaningfully.

A second issue is that real estate value reported by the 1895 report reflects property that the local official has the power to assess for taxation. Real estate exempt from taxation for various reasons (schools, churches, etc.) is not included. Estimates by the Census office of the total real estate value versus the value subject to taxation are available, but do not yield significantly different results.

Finally, the value of real estate reported by the 1895 Census report ignores completely the value of personal property, such as financial assets and the capital stocks of railroads and other corporations. Because of this absence, we are under-estimating property values. The potential biases this introduces into the empirical work are discussed below along with several variations in the specifications that attempt to deal with the problem.

In addition to the real estate value, the Census also reports the total assessed value of all properties in a county. This includes both real estate and personal property, but this does not necessarily solve the problems noted above. Assessed values were typically well below market values, and this was particularly pronounced for personal property.[16] There are also several issues regarding the relationship of farm-size distribution and assessed property values that will be dealt with following the main results. The wealth measures are thus imperfect, and so the possibility remains that regressions are showing a relation of wealth distribution to total wealth, rather than the relationship of wealth distribution to effective tax *rates* themselves.

Summary statistics of local school taxes per capita and real estate values can be found in Table 1. Mean local school taxes are about $1.33 per person for the whole sample of 1345 counties. The sample consists only of counties that report zero population in towns greater than 2500 persons. For these counties the role of personal property is less pronounced and as noted below it will be for these counties that the wealth distribution data is relevant. Real estate values are approximately $370 per person, while the assessed values are only $222, well below the value of real estate (and recall that the assessed value is supposed to include real and personal property).

On a regional basis, Table 2 shows how some of the variables vary over the United States. As can be seen, the local school taxes collected per capita range from a high of $2.95 in the West North Central to a low of $0.26 in the East South Central region. This variation appears to be due, in part, to differences in real estate values per capita. Real estate values per capita were over $600 per person in the North Central regions, but under $220 per person in the three Southern regions.

For the assessed property values, note that in New England assessed property values are actually higher than real estate values. This could be explained by a larger value of personal property per person in this region, or possibly by better techniques in finding and assessing that property in these states. For the other regions, the combined assessed value of *total* property is below the estimated value of real estate alone.

Overall, the final two columns of Table 2 show the differences between the North and South. In general, Northern school taxes were eight times higher per capita than in the South. This was due in part to the higher wealth in the North, which reported real estate values of $590 per capita, while the South only reported $200. The assessed values are higher in the North, but note that the ratio to the South is only 2-to-1, which does not explain the entire eight-fold difference in local school taxation, implying that tax rates in the South were lower.

From the table, it is apparent that several regions of the U.S. are not included in the analysis, particularly those in the Western portion of the U.S. The 1345 counties cover a total of 35 states. These include all states east of the Mississippi as well as Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, North Dakota, Nebraska, and South Dakota. The exclusion of the remaining states is due to a lack of some data as well as concerns about accurately measuring wealth distribution, which is discussed more below.

One thing that is not apparent from either summary table is the fact that there are a large number of counties that have zero reported local school taxes collected. Of the total 238 counties in this category, most are in Georgia (98), North Carolina (65), Alabama (46), and Louisiana (15).[17] This likely has as much to do with state-level institutions as with local conditions, and is consistent with the idea that fiscal responsibility was more centralized in the Southern states.[18] State fixed effects in the regressions will be able to control for the common effect on all counties within these states, but additional results below show that the results are not dependent on these specific counties. An additional point this raises is that school funding was not provided exclusively by local government units, with states collecting taxes specifically for education purposes in 31 states in 1890.[19] Local school taxes may well vary due to differences in state-level funding. Data on state-level funds *received* within a county are not available, but we do have data on the state property taxes *paid* in a county for the purposes of school funding. Inclusion of this as an

[15] U.S. Census, *Wealth, Debt, and Taxation* (1895, p. 7). Special reports from Wisconsin and Pennsylvania commissions on property values were also consulted.
[16] Fisher (1996, p. 88), Leland (1928, p. 19), Lutz (1918, p. 28).
[17] The remaining counties with no reported local school tax revenues are in Kentucky (2), Minnesota (2), South Carolina (7), South Dakota (2), and Tennessee (1).
[18] See Einhorn (2006) for a discussion of this tendency.
[19] *Wealth, Debt, and Taxation* report (1895, p. 102).

Table 1
County level summary statistics, 1890.

Variable	All	
	Mean	SD
Local sch. tax p.c.	1.328	1.652
Real estate Value p.c. (×$1000)	0.371	0.474
Assessed value p.c. (×$1000)	0.223	0.193
Farm Gini (G)	0.408	0.158
Adjusted Gini (G^A)	0.686	0.139
Share of farms 0–49 acres	0.259	0.174
Share of farms 50–99 acres	0.210	0.094
Share of farms 100–999 acres	0.523	0.214
Share of farms 1000+ acres	0.009	0.016
Output p.c. ($)	72.3	41.0
Percent black	0.174	0.234
Percent children	0.398	0.040
Population (×1000)	13.3	7.8
Observations	1345	

Notes: Property tax and wealth data is from the U.S. Census *Report on Wealth, Debt, and Taxation*, U.S. Department of the Interior (1895). "Real estate value p.c." is the reported value of real estate, and "Assessed value p.c." is the reported assessed value of all property (both real and personal). The farm Gini is calculated from farm size information in the U.S. Census of 1890, which also provides the farm share data. The adjusted Gini modifies the farm Gini by incorporating information on the number of 21+ aged males relative to the number of farms, see text. Output per capita is the sum of manufacturing output and agricultural output, as reported in the U.S. Census of 1890. Demographic variables are from the U.S. Census. The sample is limited to counties that report zero population in towns with more than 2500 persons.

additional control has no effect on the subsequent results. In addition, I use information from the *Report of the Commissioner of Education* for 1890 to generate measures of state-level expenditures and utilize this as another check on the results.

3.2. Measuring the wealth distribution

The main source of information on wealth is the distribution of all farms by size reported in the Agricultural Census of 1890. The Census reports the number of farms in each of several categories: 0 to 9 acres, 10–19 acres, 20–49 acres, 50–99 acres, 100–499 acres, 500–999 acres, and 1000+ acres. This information can be used to construct a Lorenz curve from which a Gini is calculated. The appendix gives the full details of the calculation, but the method is similar to the one used by Lee Soltow (1975) for the U.S. in the 19th century and by Deininger and Squire (1998) for a set of countries in the 20th.

The Census only reports the size distribution of farms in operation, and therefore does not perfectly capture the distribution of land *ownership*. Despite this issue, Soltow (1975, p. 132) concludes that inequality measured by these distributions is a useful indicator of relative wealth-holdings in this period. This is due, in part, to the fact that renting and share-cropping were not prevalent in most areas. For the counties included in the present study, the median proportion of farms rented was only 6.1%, while the median share-cropping proportion was 16%. However, there are certainly areas where renting and share-cropping were the main form of tenure, so that in some counties the share of farms rented was as high as 75% and in others those share-cropped made up over 60% of all farms. In the empirical work, controls for these shares can be included but do not appear to materially impact the results.

The Gini coefficient calculated across all farms (denoted G) is used as the first measure of inequality within counties. From this baseline, several additional issues can be addressed. First, the Gini does not consider the issue of propertyless farm workers, and is likely under-estimating inequality. To partially correct for this, an adjustment to the farm Gini can be made that incorporates the number of males aged 21 or more. If we let p indicate the ratio of farms to adult males, then an adjusted farm Gini (G^A) can be calculated as $G^A = pG + (1-p)$.[20] The fewer farms there are relative to adult males the lower is p, and the larger is G^A relative to G. This adjusted Gini will allow us to distinguish counties on the extent of land-holding in the population, rather than simply on the size distribution of farms. In the empirical work, I will also consider an adjusted Gini that is calculated using the ratio of farms to adult white males, as for many states the relevant distribution of wealth may exclude the black population because they have been effectively excluded from voting.

A second issue with the Gini (adjusted or not) is that it does not measure inequality in the *value* of farms, only in their size. As property taxes were based on assessed values, this is an important omission. For 1860, Soltow (1975, p. 128) calculated that the elasticity of real estate holding value with respect to acres was 1.28. This indicates a magnification of inequality over and above that measured by the Gini coefficient. If we believe that a similar effect was at work in 1890, then the Gini coefficients are under-estimating wealth inequality. Unfortunately, individual level data on wealth is not available from 1890, and so a more

[20] This adjustment is mathematically identical to that used in Soltow (1971, p. 124).

Table 2
County level summary statistics, by census region, 1890.

	Census region							Broad region	
	New England	Mid Atl.	East N. Cent.	West N. Cent.	South Atl.	East S. Cent.	West S. Cent.	North	South
Local sch. tax p.c. ($)	1.35	1.43	2.03	2.95	0.33	0.26	0.44	2.60	0.32
R.E. value p.c. (000s)	0.38	0.44	0.56	0.62	0.22	0.18	0.15	0.59	0.20
Assd. value p.c. (000s)	0.44	0.27	0.29	0.30	0.16	0.16	0.14	0.30	0.16
Farm Gini (G)	0.37	0.42	0.41	0.23	0.52	0.49	0.50	0.29	0.50
Adj. Gini (G^A)	0.75	0.81	0.75	0.57	0.75	0.70	0.73	0.63	0.73
Farm share 0–49 ac.	0.20	0.25	0.26	0.08	0.35	0.34	0.38	0.14	0.35
Farm share 50–99 ac.	0.25	0.30	0.31	0.16	0.20	0.22	0.20	0.21	0.21
Farm share 100–999 ac.	0.55	0.47	0.42	0.75	0.43	0.43	0.41	0.64	0.43
Farm share 1000+ ac.	0.00	0.00	0.00	0.01	0.01	0.01	0.02	<0.01	0.01
Observations	17	25	159	395	372	274	103	596	749

Notes: Local school taxes per capita are from the U.S. Census *Report on Wealth, Debt, and Taxation*, U.S. Dept. of the Interior (1895), with population data from the U.S. Census. "R.E. value p.c." is the reported value of real estate in the Census report, and "Assd. value p.c." is the reported assessed value of all property (both real and personal). Farm share, the farm Gini, and adjusted Gini are based on farm size distribution data and the population of males 21 and over, see text for details.

accurate adjustment is not possible. An additional aspect of this problem is that the farm size Gini likely gets less accurate as one moves into the ranching states of the West.[21] This is one of the main reasons that the counties under consideration were limited to those near or east of the Mississippi river, where this issue should be limited.

The final issue to discuss with respect to the Gini is the absence of information on non-farm wealth. While in 1890 the U.S. Census calculated that 60% of all wealth consisted of farmland, there is still a significant proportion of wealth that the Gini coefficients based on farm size are not incorporating.[22] Soltow (1971, p. 123) calculates that for Milwaukee county, Wisconsin in 1860, the actual Gini coefficient of wealth inequality was 0.89 while the Gini measured only over farmers was 0.73. This is due to a large amount of non-farm wealth held by non-farmers, consisting of personal property such as financial holdings. As might be surmised, it appears that the issue of non-farm wealth is more pronounced in large urban areas.[23] Again, without individual data from 1890 it is not possible to accurately correct the farm size Gini coefficients for this. It is for this reason that the analysis is restricted to counties in which the role of non-farm wealth should be limited: rural counties.

Table 1 shows summary statistics for the Gini coefficients from 1890. The farm size Gini averages 0.41 across the whole sample. The adjusted Gini, as expected, is significantly higher than the farm size Gini. Regionally, Table 2 shows that the West North Central region had much lower inequality than the rest of the U.S. There was some tendency for the Southern regions to have higher inequality in farm sizes, but slightly lower adjusted Ginis due to a smaller population of adult males relative to the number of farms. From the table it is apparent that those regions with the lowest average inequality also had the highest tax rates for local schooling. The state fixed effects included in the regressions will be picking this up, and the results are not driven by these broad regional differences.

For some confirmation that using farm sizes will provide meaningful information on the true wealth distribution within counties, I have compared farm shares and Gini coefficients calculated according to my methodology using the 1870 Census data to direct indices of wealth inequality calculated from the 1870 IPUMS 1% sample that includes individual-level wealth measures. Appendix B documents the analysis more carefully, but I find, at the county level, that an adjusted Gini calculated using only farm sizes and the number of males aged 21 and over is very tightly related to a Gini calculated using wealth data on household heads from IPUMS.

As noted previously, understanding the mechanisms driving the relationship of school funding to inequality requires more detail on the wealth distribution that can be provided by the Gini coefficient. The shares of farms that are in each of the size categories are also used to provide information on which type of farms were associated with higher education funding. For the empirical work, I roll several of these size categories together, and will focus on the share of farms in the following groups: 0 to 49 acres, 50–99 acres, 100–999 acres, and 1000+ acres. I have experimented with different permutations of categories, but the results all show a similar pattern.

Table 1 shows summary statistics for the farm size variables from 1890. Across the whole sample of 1345 counties, one can see that the largest fraction of farms was in the 100 to 999 acre range. Of these, about 95% were actually in the 100 to 499 acre range, so that this category is picking up mainly that share. The remaining farms were mainly split between small (0–49 acres) and medium-sized operations (50–100 acres). There is a small fraction, less than 1%, that are over 1000 acres. Recall that this sample excludes the larger ranching states of the West where this farm size is more relevant. Regionally, Table 2 breaks down similar information across the different Census regions of the U.S. One major difference can be seen between regions. The Southern regions tend to have about one-third of their farms in the small category, 0–49 acres, which is about 10 percentage points higher than that found in the north. This larger fraction of small farms seems to come mainly at the expense of the fraction in the 100–999 acre

[21] Soltow (1971, p. 132).
[22] U.S. Census, *Wealth, Debt, and Taxation* (1895).
[23] Soltow (1975, p. 107).

Table 3
Correlations of inequality and farm shares, by North and South.

	Share of farms with acreage			
	0–49	50–99	100–999	1000 +
North				
Farm Gini (G)	0.893***	0.876***	−0.962***	−0.174***
Adj. Gini (G^A)	0.646***	0.687***	−0.724***	−0.149***
South				
Farm Gini (G)	0.863***	−0.368***	−0.807***	0.304***
Adj. Gini (G^A)	0.442***	−0.307***	−0.394***	0.397***

Notes: Farm shares are from the 1890 Census. The farm Gini and adjusted Gini are calculated from the farm share data, see text. Table reports correlation coefficients across rural counties in each region, with *** indicating significance at 1%, ** at 5%, and * at 10%.

range. In addition, we can see that the only really significant presence of 1000 + acre farms is in several Southern regions, but even there the share is relatively small.

Distinguishing between the North and South, as in the final two columns, shows that there was really one significant difference in their farm size distributions. In the North the share of farms in the 0–49 acre category was 21% lower than in the South, and this was offset exactly by a 21% higher share of farms in the 100–999 acre range. Thus the main distributional difference between the regions was that in the South there was a relatively small share of large farms, and a relatively large share of small farms. This will be relevant later as we examine whether this distinction can be used to explain any of the differences in education funding between the regions.

Lastly, as noted previously, exactly how the Gini coefficient and the farm shares are related will be relevant to the differences across regions. To see this more clearly, Table 3 shows the correlation coefficients between the farm shares and the different measures of inequality, broken down by region. For the North, as can be seen, higher fractions of farms in the smallest categories (0–49 and 50–99 acres) are associated with higher Ginis, while more farms in the large categories are associated with lower Ginis. This pattern arises in part because a large fraction of farms in the North is already in the 100–999 acre category, so that increasing the number of smaller farms increases the spread and raises inequality.

This contrasts with the lower panel of 3, which shows the relationships in the South. Most notably, an increase in farms 50–99 acres is associated with a *lower* Gini coefficient, as in the South there tends to be a large number of farms in the 0–49 acres. In addition, increasing the fraction of farms in the 1000 + acre category raises is associated with a higher Gini coefficient, unlike in the North. These distinctions are the reason that the empirical work to follow will consider splitting the sample up and examining each region individually. It seems likely that the relationship of inequality and school spending will vary due to these differences.

4. Specifications and results

To begin I use the following specification,

$$(T/L)_{ij} = \alpha + \beta G_{ij} + \gamma lnW_{ij} + \delta X_{ij} + w_j + \epsilon_{ij} \tag{1}$$

where $(T/L)_{ij}$ is the local school tax revenue per capita in county i in state j, and G_{ij} is the Gini coefficient. The log of W_{ij} is the log of property values. Logged values are used because of the wide variation in this variable, but the results are not sensitive to using levels. X_{ij} represents the set of additional control variables, w_j is a fixed effect common to each county in a given state j, and ϵ_{ij} is an error term.

The X_{ij} controls incorporated into the regressions include output per capita, where output is the sum of county level measures of total farm output and total manufacturing output from the Census. These two categories are likely to understate total output due to the exclusion of services, but given the large share of agriculture and manufacturing in total economic output for the U.S. at this time, the measure should provide a suitable proxy for output per capita in 1890. The inclusion here is to control for the possibility that land inequality and property tax rates may be jointly driven by income levels.[24] Additionally, Mulligan and Shleifer (2004) propose that the absolute size of a political unit will influence its willingness to fund public goods with large fixed costs. Therefore, the total population (in thousands) is included in X_{ij} in the regression analysis.

As school taxes will be the main object of interest, a control for the percent of population made up of children (defined as those 5–20 years of age) is included. In addition, the percent of population that is black is incorporated to control for the possibility that property taxes were influenced by a desire to limit public goods for this group.[25]

[24] See Eastwood et al (2008) for evidence that farmland becomes more concentrated as economies develop.

[25] This need not be for purely racial reasons. Wright (1986, p. 79) discusses how many southern landowners were wary of providing education because this would provide their tenants with the ability to leave the agricultural labor force. There is a high correlation of the percent of population that is black with the percent of farms that are rented or share-cropped in this sample, so the percent black is picking up, to some extent, the nature of farm tenure within a county.

4.1. The baseline relationship of inequality and funding

Table 4 presents results of estimating Eq. (1) using OLS. The 1345 observations are individual counties, but recall that the measure of taxes is that levied by counties and/or sub-county governments (e.g. school districts) explicitly for the purpose of supporting schooling.

Column (1) considers the effect of the farm Gini (G) on local school taxes per capita. As can be seen, inequality is related negatively to school funding, and is significant at the 10% level. One of the concerns regarding the data was the use of the farm size distribution to capture inequality. Column (2) replaces the farm-size Gini (G) with the adjusted Gini (G^A) that incorporates information on ratio of farms to adult males. As can be seen, the estimated effect of the adjusted Gini is almost identical to that using the farm-size Gini.

The size of the effect in column (2) appears to be relatively large. A drop from the 75th percentile of the adjusted Gini (a value of about 0.77) to the 25th (a value of about 0.63) would increase local school tax revenues by $0.24 per capita. Evaluated at the mean, this represents a roughly 18% increase in local school taxes per capita.

In terms of the remaining explanatory variables, the results in Table 4 show that real estate values per capita are significantly related to tax revenues per capita, which would be expected. The coefficient indicates that a 10% increase in real estate values would lead to an approximately six cent increase in school funding per capita. The percentage of population that are children is also generally significant and negative when the adjusted Gini is the measure of inequality.

One important caveat should be attached to these results. As noted previously, the value of real estate understates total property values in a county for several reasons. If inequality were systematically related to this under-statement, then the results could be picking up this rather than a direct relationship of inequality to tax rates. Assuming that property values per capita are positively related to school taxes per capita, for this to be explaining the results it would have to be that higher inequality is significantly related to lower property values per capita. Including controls from the Census of 1890 on manufacturing capital and the value of farm implements and livestock do not alter the results significantly, but without a true measure of property values the caveat remains.

4.2. Assessment rates and property taxes

While the previous section established a significant relationship between inequality and local school taxation, these results were obtained using the real estate values found in the Census report of 1895 to control for property values. As discussed previously, this variable does not necessarily capture property values in total. In addition, it elides the issue of how inequality was related to assessed property values.

Table 4
OLS regressions for local school taxes.

	Dep. variable is local school tax revenues per capita						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					North only	South only	South only
Farm Gini (G)	−1.721*		−1.439*				
	(0.940)		(0.817)				
Adj. Gini (G^A)		−1.728*		−1.832*	−2.243**	0.079	
		(1.015)		(0.960)	(0.953)	(0.189)	
Adj. Gini (G^A) (white males)							0.007
							(0.076)
ln R.E. value p.c.	0.536***	0.546***	0.229	0.206	0.053	0.131	0.132
	(0.180)	(0.168)	(0.148)	(0.128)	(0.262)	(0.093)	(0.091)
ln assd. value p.c.			0.571**	0.644**	1.278**	0.142*	0.145*
			(0.258)	(0.274)	(0.496)	(0.070)	(0.071)
ln output p.c.	0.020	0.061	−0.003	0.039	0.281	−0.009	−0.009
	(0.198)	(0.164)	(0.205)	(0.169)	(0.197)	(0.025)	(0.025)
Percent black	0.571	0.545	0.438	0.488	−0.045	−0.085	−0.064
	(0.450)	(0.427)	(0.380)	(0.365)	(0.805)	(0.061)	(0.077)
Percent child	−2.657	−5.370**	−0.860	−3.321	1.306	−2.814*	−2.929*
	(2.233)	(2.402)	(2.406)	(2.127)	(3.080)	(1.526)	(1.456)
ln population	−0.325	−0.314	−0.291	−0.265	−0.457*	−0.004	−0.003
	(0.210)	(0.198)	(0.184)	(0.166)	(0.240)	(0.009)	(0.008)
R-squared	0.790	0.793	0.799	0.805	0.666	0.813	0.812
Observations	1345	1345	1345	1345	596	749	749
States	33	33	33	33	19	14	14

Notes: Standard errors, clustered at the state level, are reported in parentheses. All regressions include state fixed effects.
* Denotes significance at 10%.
** Denotes significance at 5%.
*** Denotes significance at 1%.

The property tax was levied on the assessed value. Therefore inequality could have been related to school tax revenues either through a) the tax rate or b) the assessment rate on property. There is a strong reason to think that inequality may in fact be related to assessment rates. As noted before, a common feature of the property tax system was that it assessed wealthier individuals at lower rates. The decline of assessment rates with wealth implies the possibility of a mechanical relationship between county-level inequality and the assessed value of property in that county. To see this, consider the following example that uses the assessment rates documented earlier by Glenn Fisher for Kansas. In a county having four farms with real value of $5000 each, the aggregate assessment rate in the county is exactly 25% and the assessed value of real property is $5000. If the county instead had one farm of $10,000, and 20 farms of $500 each (so that the total real value is the same), the aggregate assessment rate is actually 36.5% and the total assessed value is $7300. The increase in inequality has raised the aggregate assessment, even though the total value of property has not changed.

If this kind of relationship is at work within all counties, then across counties we would expect to see a positive relationship between inequality and assessment rates. Combined with the competitive under-assessments, this would mean that inequality is mechanically related negatively to the tax *rate* on assessed property.

To address this the following regressions include the county-level aggregate assessed value of property as an additional control variable along with the value of real estate. The estimated coefficient on the Gini will show the effect of inequality on tax revenues after having accounted for whatever inequality/assessment relationship exists in the data. Note that this control is not perfect, as we only have a measure of actual real estate values, while we have the assessed value of *all* property.

In Table 4, columns (3) and (4) present the results of these regressions. These results differ only in the measure of inequality used. In both cases, inequality remains negative in sign. Similar to before, the negative relationship is significant at the 10% level. Using the farm-size Gini, the estimated coefficient falls somewhat in absolute value, while for the adjusted Gini the coefficient is larger in absolute size. It does not appear that the mechanical inequality/assessment relationship was introducing a very large bias in the results.

Note that once we include the assessed value, the real estate value per capita has become insignificant, while the assessed value is now strongly related to the amount of school tax per capita. A 10% increase in assessed value is associated with an approximately 6 cent increase in school funding. Assuming that we have successfully controlled for the direct effect of wealth, the results for the Gini coefficients show us that simply making counties more unequal is associated with lower spending per capita on schools. This finding is consistent with several previous studies on inequality and schooling, but does not distinguish clearly the mechanism at work.

4.3. Differences across regions

As noted, there are distinct differences in inequality between the North and South. It was noted that inequality in the two regions was related to underlying farm sizes in different ways. Hence we may expect differences in how inequality is related to funding within the two regions. In Table 4, columns (5) and (6) I split the sample to examine this.

The 566 counties in the 19 Northern states are used in column (5), and across this sub-sample the negative relationship of inequality and school funding is very pronounced. The coefficient on the adjusted Gini coefficient is both larger in absolute value than the previous results, and the significance is much higher in this sub-sample. The implication of this estimate is that lowering the adjusted Gini by 0.14 (a drop similar to that examined previously) leads to a 31 cent increase in school funding per capita.

In contrast, column (6) uses only the 749 counties in the 14 Southern States in the sample, and here there is no evidence of a negative relationship at all. The coefficient is insignificantly estimated, but is actually positive. It appears, then, that the overall relationship in the prior columns is driven completely by the presence of the Northern counties. Across the South there is no evidence that higher inequality was associated with lower education funding.

An additional finding that arises from splitting the sample up is a difference in the estimated effect of assessed property values. For the North, the coefficient estimate (1.278) on log assessed value per capita is nine times larger than that in the South (0.142). This means that a 10% increase in assessed property values was associated with a roughly 13 cent increase in education spending in the North, but only about a 1.5 cent increase in the South. This can be roughly interpreted as a difference between the regions in the average tax rate of local authorities. As will be discussed in more detail below, this partly represents the fact that Southern states were more centralized, with a greater proportion of taxation and expenditure occurring at the state level, but nevertheless the comparison remains rather stark.

The final column of Table 4 alters the measure of inequality in the South to be the adjusted Gini calculated over only adult white males. Given the many restrictions on voting by the black population in this period, their wealth may not have been relevant to choices for local school funding. As can be seen, though, in column (7), using this alternative measure of inequality does not fundamentally change the outcome that inequality was unrelated to school funding across Southern counties.

5. Farm size shares and regional differences

The prior section established that the overall negative relationship of inequality and school funding was driven by the North, while Southern counties did not display this inverse correlation. We can now turn to the more detailed farm size distribution data to try and establish whether there was still a similar underlying mechanism at work in the two regions, or whether different explanations are necessary.

To proceed, I turn to specifications of the following form:

$$(T/L)_{ij} = \alpha + \beta_1 F_{ij}^{0-49} + \beta_2 F_{ij}^{100-999} + \beta_3 F_{ij}^{1000+} + \gamma ln W_{ij} + \delta X_{ij} + w_j + \epsilon_{ij}. \quad (2)$$

The three F_{ij} terms are the share of farms in the noted categories. The fraction of farms in the 50–99 acre range is the excluded category. The interpretation of the β values is the effect of an increase in the fraction of the given category relative to the fraction of farms in the 50–99 acre category.

Table 5 shows the results of several regressions of the specification in Eq. (2). Column (1) includes all counties. Both β_1 and β_2 are significantly positive, meaning that counties with a greater share of farms in either the smallest category (0–49 acres) or larger category (100–999 acres) maintained higher school funding compared to counties with a greater share of farms in the 50–99 acre category. The estimate for β_3, on the farms of 1000+ acres, is negative but also completely insignificant. This will generally be the case as there is very little variation in the fraction of farms over 1000 acres in the data.

In columns (2) and (3), this pattern holds up after including controls for both the assessed value of property per capita, as well as the log of average farm size. In all cases, more farms in the small or large category imply higher spending on schooling.

This pattern of results is surprising from the perspective of the typical median voter model. In that framework it makes sense that low-wealth households with 0–49 acres are more supportive of education spending than those in the 50–99 acre category. However, we would expect that as wealth increases further support for education would fall further—the β_2 is expected to be negative or zero. The results in columns (1) through (3), though, show that a higher proportion of large farms is definitively positive for education spending.

While the positive β_2 coefficient is hard to reconcile with the standard median voter model, it can be understood when we account for declining assessment rates. Recall from Fig. 2 that in scenario *C*, where the benefits of education are positive for all households but also are increasing with wealth, there is the possibility of a non-monotonic relationship between farm size and support for education. As drawn in the figure, households with 0–49 acres as well as those with more than 100 acres will support education, while those in the 50–99 acre category will oppose it. That is precisely the pattern seen in the regression results, with $\beta_1 > 0$ and $\beta_2 > 0$. While I cannot make any definitive conclusions on the benefits of education, the results are consistent with the benefits being positive for all households, but rising with wealth, as in scenario *C* in Fig. 2.

Table 5
OLS regressions for local school taxes.

	Dep. variable: Local school tax rev. per capita				
	(1)	(2)	(3)	(4) North only	(5) South only
Farm shares. Excluded category is 50–99 acres					
0–49 acres (β_1)	2.002*	2.072**	2.028**	3.838**	−0.387
	(1.072)	(1.053)	(0.994)	(1.883)	(0.245)
100–999 acres (β_2)	2.614**	2.434**	2.593**	3.195**	−0.466
	(1.128)	(1.027)	(1.320)	(1.543)	(0.363)
1000+ acres (β_3)	−2.205	−2.328	−0.840	1.790	−1.149
	(2.254)	(2.349)	(3.534)	(16.006)	(0.875)
Additional controls					
ln R.E. value p.c.	0.525***	0.220	0.224	0.011	0.120
	(0.174)	(0.154)	(0.150)	(0.307)	(0.095)
ln assd. value p.c.		0.569**	0.568**	1.253**	0.156**
		(0.268)	(0.266)	(0.521)	(0.076)
ln avg. farm size			−0.133	0.476	0.020
			(0.439)	(0.930)	(0.105)
ln output p.c.	0.023	0.005	0.011	0.199	−0.004
	(0.186)	(0.192)	(0.177)	(0.169)	(0.026)
Percent black	0.162	0.023	0.047	−1.525*	−0.034
	(0.242)	(0.206)	(0.274)	(0.903)	(0.060)
Percent children	−2.463	−0.616	−0.483	4.986	−3.052**
	(2.291)	(2.472)	(2.451)	(3.866)	(1.363)
ln population	−0.257	−0.232	−0.233	−0.376	−0.023
	(0.203)	(0.181)	(0.185)	(0.270)	(0.014)
R-squared	0.79	0.80	0.80	0.67	0.82
Observations	1345	1345	1345	596	749
States	33	33	33	19	14

Notes: Standard errors, clustered at the state level, are reported in parentheses. All regressions include state fixed effects.
* Denotes significance at 10%.
** Denotes significance at 5%.
*** Denotes significance at 1%.

Similar to before, however, there are disparities between regions in the results. Column (4) shows that the overall pattern is again driven by the Northern counties. Here, the strength of the positive effects of small and large farms is only strengthened in absolute size. These are meaningful effects. In the North, increasing the share of small farms by 10 percentage points implies a 38 cent increase in school taxation per capita, and a similar increase in the share of large farms implies a 32 cent increase. In the South there is no significant relationship between the distribution of farms by size and the spending on education. The signs of the coefficients in the South are all opposite of those in the North, but none are significantly different from zero.

Stopping here for a moment, these results provide a direct way of understanding why there was a negative relationship of inequality (as measured by the Gini) and education funding across the North. Recall from Table 3 that in the North the Gini coefficient is positively associated with a greater fraction of farms in the 50–99 acre range. This is also the range of farms that were most detrimental to school funding. Hence we have a negative relationship between the Gini itself and school funding.

5.1. Farm size and schooling in the South

While the previous results provide a clear way of understanding the mechanisms at work in the Northern counties, the South does not fit into neatly into this same explanation. Looking back at Table 5, column (5) looks at the relationship of farm size shares to education funding in only the Southern counties. As can be seen, there is no significant relationship between local farm size shares and education spending.[26]

The fact that across Southern counties there is no significant relationship between farm sizes and local school taxation provides, mechanically at least, an explanation for the insignificant relationship of the Gini coefficient and school taxation seen in Table 4. When we look across Southern counties, as in Table 3, there is a slight negative relationship between the share of farms in the 50–99 acre range and the adjusted Gini (G^A). However, there is essentially no significant relationship between the share of farms in the 50–99 acre range and school funding, and hence we have no overall relationship of school funding and inequality.

What, then, is the appropriate way to explain the situation in the South? As noted earlier, much of the school spending in the South was determined at the state level as opposed to locally. The *Report of the Commissioner of Education for 1890* (U.S. Department of the Interior, Census Office, 1893) suggests that one of the reasons Southern education funding lagged behind the North is that the relatively high level of state-level school taxation gave localities (counties and municipalities) little incentive to supply their own funds (p. 23–24). Given that, it is perhaps unsurprising that local conditions have no significant effect.

Table 6 presents a series of further regressions that show that the lack of significant results is a consistent feature of the data, and not simply the result of the specification used previously. To begin, recall that a significant portion of the counties in the sample had zero local school financing reported to the Census, relying entirely on state-level funding. These counties lie almost exclusively in Southern states (specifically Alabama, Georgia, Louisiana, and North Carolina). Do these counties drive the overall result? Table 6 presents in column (1) the regression of local school taxes per capita on farm shares, limiting the sample to only those 515 counties in the South that have a positive level of school funding. As can be seen, there is essentially no difference in these results from those that include all Southern counties. There are insignificant negative coefficients on all three farm share variables.

In column (2), I look not at the level of local school funding, but rather at the presence of local school funding at all. A dummy was created that equaled zero for the 234 counties with no local taxation, and equaled one for the remainder. In this situation, the results show that there was a significant negative effect of small farms (0–49 acres) on the presence of local school taxation.

Column (3) in Table 6 includes an additional control for the level of state school taxation per capita, and uses again the dummy variable for local funding as the dependent variable. What can be seen here is that the point estimates are nearly identical to column (2), but there is a very slight change in the standard errors, so that now 100–999 acre farms show a weakly significant, negative effect on the presence of local school taxation. What column (3) indicates is that if there was any effect of the local distribution of wealth on school funding in Southern counties, it had to do with the binary decision to supplement state funds with their own. The coefficients indicate that counties with larger proportions of 50–99 acre farms (the excluded category) were more likely to have levied local school taxes.

Local farm size distribution may have influenced whether counties provided some local funding, but did this show up as a significant difference in the total amount of education funding done by all levels of government? To answer this I incorporate information on state expenditures. The report on *Wealth, Debt, and Taxation* does not provide state expenditures by county, but only the amount of state taxes. To develop a measure of total expenditures on education in a county, I rely on the overview in the *Report of the Commissioner for Education for 1890* which states that, almost universally, state education taxes in the South were allocated to localities in equal per-pupil amounts.

Using that piece of information, I first determine the per-pupil amount by dividing total state taxes in a given state by total reported pupils in the 1890 Census. For each county, I measure total school expenditures as local school taxation plus the multiple of the county's pupils and the state per-pupil allocation. This total expenditure is then divided by the population of the county to arrive at total school expenditures per capita in a county. In column (4) of Table 6 I regress this on the various farm shares, and as can be seen there is no significant result, but the point estimates are all negative. There is no distinction between local school taxation and total school expenditures in their relationship to the wealth distribution. Even though farm size distributions may have influenced whether counties levied school taxes on themselves, this did not contribute significantly to differences in school funding across counties.

[26] Note that even if we assume that, in the South, a different category of farms qualified as "medium-sized", then the results are still not consistent. If 100–999 acre farms are medium in the South, for example, then we still should have seen a positive coefficient on the smallest farms (0–49 acres), as well as on the largest farms (1000+ acres), which we clearly do not. The underlying relationship in the South, then, is distinctly different from that in the North.

Table 6
OLS regressions for school funding in Southern counties only.

	Dep. variable						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Local taxes p.c.	Tax dummy	Tax dummy	All expend. p.c.	Local taxes p.c.	Local taxes p.c.	Tax dummy
Farm shares. Excluded category is 50–99 Acres							
0–49 acres (β_1)	−0.543	−0.372**	−0.373**	−0.459	−0.158	−0.197	0.171
	(0.319)	(0.149)	(0.150)	(0.265)	(0.333)	(0.301)	(0.129)
100–999 acres (β_2)	−0.573	−0.492	−0.490*	−0.446	−0.246	−0.266	−0.132
	(0.486)	(0.278)	(0.276)	(0.433)	(0.349)	(0.327)	(0.204)
1000+ acres (β_3)	−1.369	−0.084	−0.156	−1.079	−1.060*	−0.860*	−0.720**
	(0.971)	(0.587)	(0.596)	(0.996)	(0.576)	(0.447)	(0.329)
Additional controls							
ln R.E. value p.c.	0.135	0.001	0.008	0.111	0.126	0.107	0.013
	(0.109)	(0.030)	(0.029)	(0.099)	(0.090)	(0.081)	(0.031)
ln assd. value p.c.	0.171*	0.030	0.052	0.158*	0.148*	0.086	0.048
	(0.089)	(0.034)	(0.048)	(0.079)	(0.072)	(0.082)	0.041
ln avg. farm size	−0.001	0.061	0.062	−0.023	0.016	0.010	0.099
	(0.141)	(0.069)	(0.068)	(0.118)	(0.054)	(0.052)	(0.085)
ln output p.c.	−0.018	0.016	0.018	−0.023	−0.001	−0.007	0.025
	(0.038)	(0.022)	(0.021)	(0.028)	(0.028)	(0.028)	(0.023)
Percent black	−0.070	0.011	0.014	−0.115	−0.007	−0.014	0.021
	(0.117)	(0.061)	(0.059)	(0.084)	(0.069)	(0.068)	(0.025)
Percent children	−3.781**	−0.572	−0.700	−2.079	−3.027*	−2.673*	−0.550
	(1.527)	(0.492)	(0.519)	(1.428)	(1.406)	(1.296)	(0.520)
ln population	−0.039*	0.038*	0.038*	−0.036*	−0.020	−0.021	0.047**
	(0.022)	(0.019)	(0.019)	(0.017)	(0.013)	(0.013)	0.021
State school taxes p.c.			−0.143			0.400	−0.185
			(0.094)			(0.500)	0.109
R-squared	0.779	0.776	0.777	0.805	0.816	0.821	0.778
Observations	515	749	749	749	749	749	749
States	14	14	14	14	14	14	14
Farm shares	All	All	All	All	Owned	Owned	Owned
Local funding	>0	≥0	≥0	≥0	≥0	≥0	≥0

Notes: Standard errors, clustered at the state level, are reported in parentheses. * denotes significance at 10%, ** denotes 5%, and *** denotes 1%. The dependent variable in columns (3) and (4) is a dummy coded 0 if local school tax revenues are equal to zero, and 1 otherwise. All regressions include state fixed effects.

A final factor worth considering is that the distribution of wealth across *all* farms is not the correct distribution to look at. From the Census, for the 749 rural Southern counties in the sample, on average 54% of the smallest farms (0–49 acres) were either rented or share-cropped. This ranges from a low of 0% all the way to 98%, with 61 counties having values higher than 90%. While I do not have specific data on the race of the operators of these farms, it would seem likely that these small farmers are primarily black, and hence were subject to limitations on their voting. Even for white share-croppers and tenants, their political influence may have been less than their share of the population would indicate.

To address this, I consider the distribution of farm shares over only farms that are owned, with the idea that those who *own* farms are more likely to be allowed to vote and to be participants in the political discussions regarding education funding. Column (5) of Table 6 uses these farm shares as explanatory variables, while local school taxes per capita are again the dependent variable. As can be seen, there is some change in the pattern of coefficient estimates. There is again a negative coefficient on both small farms and the large farms, but the point estimates are distinctly smaller and they remain statistically insignificant.

However, there is now some evidence of an effect of the very largest farms (1000+ acres). Here, at the 10% level of significance, there is a negative effect on local school funding. In column (6) the regression is modified to include a specific control for state school taxes per capita, and the size of the coefficient on the farm share of 1000+ acres declines somewhat, but remains significant at 10%. The size of this effect is that increasing the share of very large farms by one percentage point is associated with a fall in local school funding of not quite 1 cent per person. This is equivalent to a roughly 3% fall in funding relative to the average across Southern counties (32 cents per capita).

In column (7), I replace school taxes per capita with the local school tax dummy, and the results are similar. The effect of very large farms on the presence of any local school funding is now significant at 5%, while the coefficients on the other farm size categories are now very small in absolute value and insignificant. The interpretation of this coefficient is different than in the previous column. Here, a one percentage point increase in the share of very large farms implies that the probability of a county having any local school funding is lower by about 0.7%.

Overall, the last three columns in Table 6 point towards a similar conclusion to that reached in Table 5, which is that local farm size distributions are not particularly important for local school funding in the South. The only caveat to this conclusion is that there is some evidence that a greater share of very large farms (1000+ acres) is associated with slightly lower school funding.

Compared to the North, however, any conclusions regarding the South are far more tentative. One issue is that across the South local school funding was very low universally, and did not vary much across counties. Average per capita local school taxation in the South was only 32 cents, while in the North it was $2.60. Relevant for the statistical analysis is that the standard deviation across the South was only 42 cents, while it was $1.74 in the North. The cross-county variation in the South is quite small, leaving little room for county-level explanations. Rather, it appears that regional-level explanations are more appropriate. In particular, given that most education funding was provided at the state level, there was little scope for local wealth distributions to influence school spending.

5.2. Explaining regional differences

An interesting implication of the results relates to the role of inequality in determining the overall gap between the North and South in education funding. The South, as noted, raised on average only one-eighth the revenue of the North to support schooling.

We can use the regression results to speculate on how school funding would have changed in the South if the farm size distribution was re-arranged to match that of the North. In general, this would lower the Gini coefficient in the South, but as it turns out would have essentially no net effect on school funding.

To see this, recall from Table 2 that the South had a much larger fraction of farms in the 0–49 acre category, and this was matched by a much smaller fraction of farms in the 100–999 acre category. More thoroughly,

$$F^{0-49}_{North} - F^{0-49}_{South} = 0.14 - 0.35 = -0.21 \tag{3}$$

$$F^{100-999}_{North} - F^{100-999}_{South} = 0.64 - 0.43 = 0.21. \tag{4}$$

The differences in the shares in the 50–99 acre category and the 1000+ acre category are so minor that they have no meaningful quantitative effect on the calculations.

To predict how much education taxation per capita would change by switching to the Northern distribution, I can utilize the results of the regressions. Specifically, the change in education funding is

$$\Delta T/L = \beta_1\left(F^{0-49}_{North} - F^{0-49}_{South}\right) + \beta_2\left(F^{100-999}_{North} - F^{100-999}_{South}\right) \tag{5}$$

$$= 0.21 \times (\beta_2 - \beta_1) \tag{6}$$

where the second line follows from inserting the prior differences in farm shares. As can be seen, the effect on school taxation depends entirely on the difference in the estimated coefficients β_1 and β_2. If this difference is positive, then this would indicate that shifting the Southern farm distribution to that of the North would have raised school taxation.

However, as can be seen in Tables 5 and 6, in no case is there a very distinct difference between β_1 and β_2. In almost every case, these values are of the same sign, and typically very close in size. Statistically speaking, for the regressions in Table 6 over only the Southern counties, one cannot reject that $\beta_2 = \beta_1$. In this case, the change in education funding would be predicted to be zero.

A concrete example is to use the estimates from column (6) of Table 6, where $\beta_1 = -0.197$ and $\beta_2 = -0.266$. The predicted difference in local school taxes per capita is then $\Delta T/L = 0.21 \times (-0.266 + 0.197) = -0.014$. Switching to a Northern farm distribution would actually predict a *fall* in school funding per capita of 1.4 cents.

Even if one were to use the larger point estimates in Table 5 obtained while including the Northern counties in the regressions, the effects of a redistribution are still small. Taking column (3) of Table 5 as the relevant estimates, the predicted change in local school funding is $\Delta T/L = 0.21 \times (2.593 - 2.028) = 0.12$, or twelve cents. This is a relatively large increase relative to the average across the South of 32 cents, but the gap between the North and South is much larger, at $2.28.

It is thus very hard to find a way in which the farm size distribution itself was an important contributor to the differences in local school funding between North and South. Indirectly, inequality may have influenced wealth or other inputs into the education funding decision, but the direct effect appears to be quite small.

6. Conclusion

In 1890, the general property tax was the primary source of revenue for counties, municipalities, and school districts within the United States. The taxation varied greatly, and this contributed to variation in funding for public schools. This paper shows that inequality, measured by the distribution of farm sizes within counties, does not have a consistently negative relationship with local school tax revenues in the U.S., but varies distinctly between regions.

Several different means of measuring inequality and sub-samples of counties are used to control for the fact that farm size distributions are not perfect measures of wealth inequality, and the results are robust in each case. Results control for the value of real estate in a county, as estimated by the Census. The possible biases introduced because of declining assessment rates and competitive under-assessment are controlled for by including the total assessed value of property (both real and personal) in a county.

For the overall sample of U.S. counties, while there is a significant negative relationship of inequality to school taxation across rural counties, within the sample there is a break. The negative relationship turns out to be a feature only in the North, while in the

South counties display an insignificant positive relationship. Exploring these differences further by looking directly at the share of farms in various size categories, I find that in the North there was an "middle against the ends" situation, in which medium-sized farms were associated with lower education spending, consistent with a median-voter model with declining assessment rates.

The South displayed no similar set of relationships, consistent with the fact that school funding was determined at the state level as opposed to locally. Additionally, there is no evidence that the more unequally distributed farm sizes in the South played a meaningful role in their dramatically lower levels of school funding in 1890 compared to the North.

Appendix A. Land distribution measures

From the Agricultural Census of 1890 distribution of farms by size is available. The categories of size are as follows: under 10 acres, 10–19 acres, 20–49 acres, 50–99 acres, 100–499 acres, 500–999 acres, and greater than 1000 acres. This distribution, combined with assumptions about the average area of farms within each category, allows for the estimation of a Gini coefficient.

A more formal definition is as follows. There are eight size categories, including a placeholder category that measures farms of size zero (set equal to zero), numbered from 1 to 8 in order of increasing size of farms. Let f_i be the share of all farms that are in category i. Let a_i be the share of all acreage that is in category i. Now let $F_i = \sum_{s=1}^{i} f_s$, which denotes the share of farms that are of size i or smaller. Similarly, $A_i = sum_{s=1}^{i} a_s$. By definition, $F_8 = A_8 = 1$. It can be shown that the Gini coefficient, G, can be calculated as follows

$$G = 1 - \sum_{i=1}^{8} (F_{i+1} - F_i)(A_{i+1} + A_i). \tag{7}$$

This method requires data on the share of acreage in each farm size category, which is not actually reported in the census of 1890. In the absence of this data, it is assumed that each farm within a category is the average number of acres for that category. Therefore, the size of all farms in the 10–19 acre category is assumed to be 14.5 acres. This method conforms to the evidence found in the 1920 Agricultural Census, which actually reports acreage data by category. This leaves the category of farms greater than 1000 acres. For these farms, it is assumed that each farm is actually 1000 acres. Various values for this category were tested, and there were never significant changes in the Gini coefficients.

Appendix B. Comparing inequality measures in 1870

The inequality measures from 1890 are based on farm sizes, as individual data is not available on wealth holdings. While several adjustments to the calculation of the Gini and the sample are made to try and find an accurate representation of wealth inequality, there are certainly still questions as to the quality of this representation.

In 1870, individual wealth data is available along with farm size data. This allows me to calculate Gini indices using both and assess the accuracy of the farm-size based Gini. The farm-size Gini is calculated in exactly the same method as used for the 1890 data. The only difference is that the actual category sizes in 1870 are slightly different than those used in 1890. I also calculate an adjusted Gini in a similar manner to that used for the 1890 data, where the farm-size Gini is adjusted by the number of farms relative to the size of the adult male population (in the case of 1870, the number of males 21 and over).

For the individual level measures, I use the 1870 1% national sample from IPUMS (Ruggles et al, 2010). This includes two wealth variables: value of real property and value of personal property. From these I also calculate total property by adding the two reported values. There are 383,358 total individual records, of which 59,661 report a positive value of either real or personal property. One item of note is that the 1870 Census did not record values for personal property if its value was below $100, which means that very likely many of the zero values are actually small positive amounts.

Looking at the wealth measures, for rural individuals that report any property, the median share of wealth that is in real estate is 67%. For comparison, for urban individuals the median share of wealth in real estate is 47%. So rural individuals typically had a great fraction of the wealth held as real estate. In the empirical analysis of the paper, the log of real estate value is used to control for overall wealth. In the 1870 sample, log real estate is highly correlated with total wealth. For rural individuals reporting any property, the correlation of log real estate wealth and log total wealth is 0.96, significant at less than 1%. In 1870, then, real estate wealth provides a significant amount of information about total wealth within rural counties.

Of those with some property reported, about two-thirds (40,860), are heads of households. The total number of heads of households in the entire sample is 75,297, so just over half of the heads report positive total property values (meaning that they have less than $100 in personal property and no reported real estate). I focus on inequality across household heads for several reasons. First, calculating inequality across all individuals in the IPUMS sample (which includes children) almost universally yields Gini coefficients for counties above 0.97. The inequality within households (i.e. between heads with positive wealth and spouses and children with none) swamps the measurement of inequality between households. Second, the political economy models used to explain the relationship of inequality and public goods seem to have in mind incentives of households as a unit rather than the incentives of various members within households.

As a baseline, then, I calculate a Gini index over total property at the county level using the 1870 IPUMS sample. All household heads, whether reported as urban or rural, are included in the calculation. It is assumed that this IPUMS Gini coefficient captures the “true” inequality within a county, and we can now assess the quality of the adjusted farm-size Gini by seeing how well it matches the IPUMS measure.

To do this, consider a simple univariate regression of the IPUMS Gini on the adjusted farm-size Gini. The sample is restricted to counties that lie within states included in my original analysis from 1890 to make the most relevant comparisons possible. The table included here shows the results of this regression in column (1).

Table A.1
Relationship of inequality measures in 1870.

	Dep var: IPUMS Gini			
	(1)	(2)	(3)	(4)
Adj. Gini (G^A)	0.807	0.906	0.971	0.983
s.e.	(0.032)	(0.035)	(0.044)	(0.051)
Constant	0.026	−0.025	−0.083	−0.071
s.e.	(0.026)	(0.029)	(0.037)	(0.040)
R-squared	0.253	0.372	0.395	0.356
Counties	1852	1113	742	687
Min. IPUMS obs.	0	20	30	20
Urban/rural	Both	Both	Both	Rural

As can be seen, there is a very strong relationship between the adjusted farm-size Gini and the Gini calculated from IPUMS data. The constant is not statistically different from zero, so there is no evidence of a fixed over- or under-statement of inequality by using the adjusted farm-size Gini. The coefficient on the adjusted Gini is 0.807, meaning that as the adjusted Gini rises, it tends to overstate the true rise in inequality.

One important note, though, is that in column (1) I have utilized all counties, regardless of how many individual records from IPUMS were used to calculate the Gini. Some of these counties are sparsely populated, and the 1% IPUMS sample often leaves me with only 2 or 3 household heads in a county. If I limit counties to those in which there are a minimum of 20 household head records, as in column (2) above, then I have 1113 counties to do the comparison over. As can be seen, the ability of the adjusted Gini to capture “true” inequality is stronger, with a higher R-squared, and a coefficient estimate closer to one. If I limit the sample further to those counties with at least 30 household head records in IPUMS, then column (3) demonstrates that the relationship is nearly one-for-one between the adjusted Gini and the true measure of inequality.

With the 1890 counties, I restricted myself to those that were rural (meaning they had no population in towns greater than 2500 people). I can do the same here, in column (4), again restricting myself to counties with at least 20 household head records. This limits me to 687 counties, but as can be seen for these counties the adjusted Gini and the IPUMS Gini are very closely aligned.

For 1870, then, it appears that a suitably adjusted farm-size Gini matches quite closely the best available evidence on true inequality from IPUMS. This is a similar conclusion to that reached by Soltow (1975), who felt that farm sizes were an appropriate measure of wealth inequality in this period of U.S. history. Concluding that the 1890 data on the adjusted farm-size Gini is also a suitable measure of true wealth inequality does not seem far-fetched given this evidence, but of course some uncertainty must remain.

It is worth noting what kind of potential bias using the farm-size Gini might introduce into the final regressions. Let us say that the true relationship is

$$T/L = a + bG^I + e \tag{8}$$

where T/L is the taxes per capita, a is an intercept term, G^I is the true wealth Gini from IPUMS, b is the marginal effect of this on taxes per capita, and e is an error term. If we have a substitute for the IPUMS Gini, the adjusted Gini, that is related to the IPUMS Gini as follows

$$G^I = c + dG^A + v \tag{9}$$

where c is a constant, d is the marginal relationship of the two measures, and v is the error involved in using the adjusted Gini, then we have

$$T/L = (a + bc) + bdG^A + (bv + e) \tag{10}$$

as the actual equation that I am estimating when I regress taxes per capita on the adjusted Gini. Using the adjusted Gini will imply that the intercept term is shifted by the amount bc, which does not generate any concerns. The coefficient on G^A in the regression is actually giving us an estimated value of bd, not b. Thus the regression coefficient on G^A is biased away from the true effect by the factor d. What is d? That is the coefficient on the adjusted Gini when regressing the IPUMS Gini on the adjusted Gini, and as seen above in Table A.1 that value is very close to one which implies that the bias in using the adjusted Gini is actually quite small, and that the true effect of the IPUMS Gini on taxes per capita is slightly larger than the effect estimated using the adjusted Gini.

The final effect of using the adjusted Gini is on the error term, $bv + e$. This simply tells us that by using the adjusted Gini we are introducing additional noise (from v) into our estimation. Practically speaking, this will inflate the standard errors when using the adjusted Gini, making it less likely that we will find a statistically significant effect. If the coefficient on the adjusted Gini does come out significant, this simply indicates that the additional variance introduced by using the adjusted Gini was not very large.

Given the tight relationship seen in Table A.1 between the adjusted and IPUMS Gini, using the adjusted Gini would not appear to necessarily introduce any significant bias in 1870. To the extent that the relationship between adjusted and true Gini remains similar in 1890, then there will not be any significant bias in 1890 either. However, it certainly is possible that some fundamental relationship between adjusted farm-size Ginis and true wealth inequality changed by 1890. By limiting the sample in 1890 to only rural counties, I am attempting to limit the possibility of such a changed relationship.

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