

**The Efficiency Gains from Agricultural
Land Tax Reform: England 1836-1855**

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Abstract

The theoretical efficiency advantages of land site value taxation have been known since at least the time of Adam Smith. But the practical gains from switching taxation of land to this basis have never been measured. Indeed economic theory suggests the deadweight loss from a moderate output tax would likely also be modest. The Tithe Commutation Act of 1836 in England switched taxation of large areas of farmland from a tax on gross output to a lump sum tax on the site value of land. We estimate the rent gains from the reform between 1836 and 1855 using data from 5,422 parishes. We show that converting the tax to a lump sum basis raised rents by £0.63 for every £1 of tax collected. While some of these rent gains may have stemmed from increased investment by landlords in fixed capital such as buildings rented with the land, we argue that much of this increase must have been efficiency gains. Thus the excess burden of the tithe was substantial.

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The Efficiency Gains from Agricultural Land Tax Reform: England 1836-1855

Introduction

Taxation of agriculture has generally been based either on the improved rental value of land, or on the value of output. Since the time of Adam Smith economists have argued that such taxes induce changes in behavior by taxpayers, and thus are raised with some social cost. Adam Smith in the *Wealth of Nations*, for example, calls the tithe, a tax on gross output, “always a great discouragement both to the improvements of the landlord and to the cultivation of the farmer.”¹ A classic result of public finance, however, is that one of the few non-distortionary taxes is a tax on the site value of land. Because the amount of such a tax is independent of the produce of the land it therefore should not distort land use decisions. A lump sum tax on land “cannot cause the owner to shift production to another location and does not provide a disincentive to new building, renovation and improvement, or more intensive use of the site.”² The followers of Henry George have argued for a general system of site value taxation partly on these grounds. But how important is this theoretical efficiency gain in practice? How much does it cost to raise one unit of revenue through a tax on improved land rental values, or a tax on gross output relative to site value taxation?

We could find no previous work that empirically estimated the potential size of these losses. In fact, publications on the potential benefits of site value taxation are notable for the lack of reference to empirical evidence.³ This paper seeks to provide such evidence by measuring the potential efficiency gains from switching to a system of site value taxation of agricultural land using the Tithe Commutation Act of 1836 in England as the test case. We find strong evidence of substantial potential efficiency gains due to the 1836 Act. Our estimate is that each £1 raised through the tithe reduced rents by an additional £0.63. Not all of this £0.63 would be excess burden, since some may have come from reduced investment in fixed capital associated with land, but we argue that a substantial share would be. We thus find a much larger excess burden of the tax even than simple economic theory would predict.

2. The Expected Effects of a Gross Output Tax (such as tithe) on Rents

Figure 1 gives a partial equilibrium picture of one way in which production decisions might be distorted by a percentage tax on gross output such as the tithe. Farmers in this example are assumed to use just land and labor in producing output. The wage and output

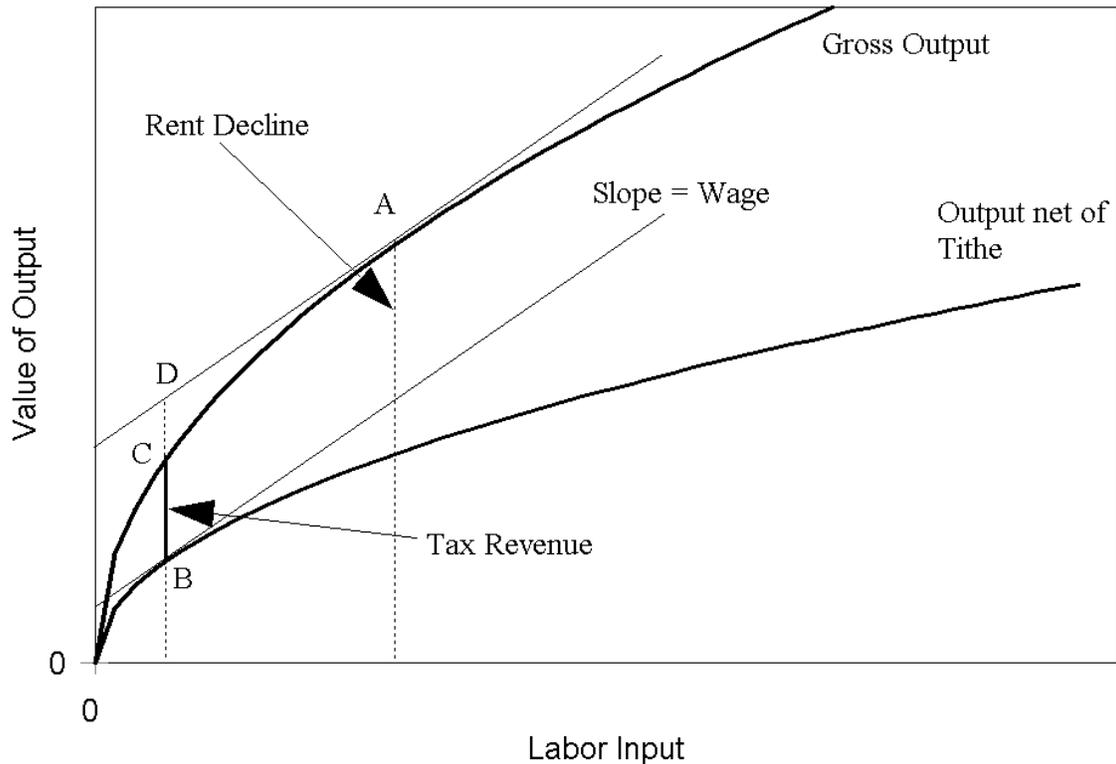
¹ Smith (1937), p. 789. See Evans (1976) for a more complete discussion of the English tithe.

² Youngman and Malme (1998).

³ See, for example, the essays in Tideman (1994), and Lindholm and Lynn (1982), and Skinner (1991). Other papers focus on the revenue base and the neutrality of alternative tax systems, but do not provide empirical evidence on efficiency gains from switching systems.

price is assumed fixed. In this circumstance the tax falls entirely on the landowner, and shows up as a reduction in rents.⁴

Figure 1: The Expected Effects of Tithe on Rents



The upper curve shows gross output, the lower curve output net of the tax. The tax revenue is thus the difference between the upper and lower curves at the amount of labor input the farmer chooses. Farmers will employ labor up until the marginal revenue product of the last worker, net of the tax, equals the wage. Without the tax they choose point A where the tangency of the production function just equals the wage. With the tax that tangency occurs with less labor input, at point B, and so gross output falls after the tax is imposed. The land rent before and after the tax is indicated on the diagram by the distance from the origin to the point where the tangents to the curve at A and B intersect the axis. Thus the decline in land rents is the vertical distance between the two tangents (which equals BD in the diagram). As can be seen with the assumptions we have made the decline in rents BD will exceed the revenue collected BC. The difference, CD, is the

⁴ David Ricardo, writing about the tithe in the early nineteenth century argued that the tax fell entirely on consumers through increased food prices. But he did this on the assumption that all of land rent was a payment for site value (Ricardo (1871), pp. 104-106).

excess burden of the tax. This excess burden is the potential social gain from transforming the output tax into a lump sum payment.

If this excess burden is large relative to the tax revenue collected, then the cost associated with a tithe will be large, as will the potential gains from reform. If however this ratio is small, then the tax is basically an income transfer and this issue becomes more theoretical than practical. Suppose, for example, that output was produced with a Cobb-Douglas production function where the share of land in input costs was .25 and the share of labor 0.75. Then a 4% tax on output (which as we shall see below was the effective rate at which the tithe was collected) would reduce labor inputs by farmers by 15%, and would reduce land rents also by 15%. But the excess burden of the tax would be only \$.06 for every \$1 collected in revenue. The distortionary costs of an output tax seem theoretically to be small for moderate rates of taxation.

As figure 2 shows a lump sum tax, fixed irrespective of output or inputs, will not lead to any change in production decisions, and will result in a decline in rents that equals the amount of the tax collected. Thus switching from a gross output tax to a lump sum tax that raises the same revenue should result in an increase in the rent of the land.

Figure 2: The Expected Effects a Lump Sum Tax on Rents

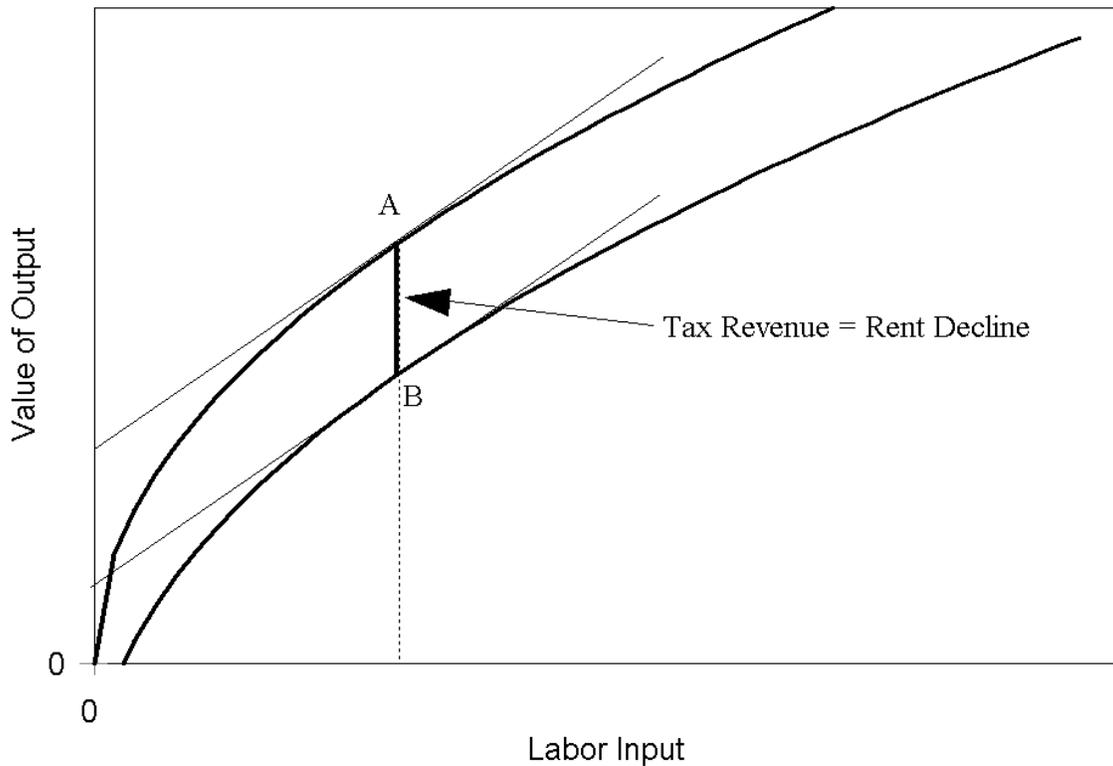


Figure 1 has been drawn on the assumption that output prices and wages do not change with the tax. If the tax does reduce output and labor demand then there may be a second effect whereby real wages, measured in terms of farm output fall as a result of the decline in food supply and the decline in labor demand. This second round effect will mitigate the decline in rents by making the post tithe wage slope flatter. Some of the burden of the tax in this case is borne by workers and consumers, as Ricardo envisioned. Thus the decline in rents, since it only measures the incidence of the tithe on landowners represents a lower bound measure of the excess burden of the tax. In the case we examine below, England in 1842, we expect these general equilibrium effects to be small. Tithe was only collected from roughly 70 percent of the land area of England by 1836. It was collected at a practical rate well below 10 percent of gross output. And there were imports of food from Ireland. Thus the effect of tithe on food supply was modest. Similarly the land subject to tithe used only about 15 percent of the labor supply in England in 1836, so the effect of reductions in labor demand would again be minimal.

Figure 1 has also been drawn on the assumption that the variable inputs such as labor and capital are all supplied by the farmer. In practice the landowner supplied the fixed capital such as buildings and fences and the rental value of land included returns to this fixed capital as well as site value rents. This means that a gain in rent from changing the basis of the tax system may not all be from reduced excess burden, but may partially stem from greater investments by landlords in fixed capital. We consider below the maximum contribution increased investment in fixed capital might have played in causing the increase in rents.

3. Historical Background to the Tax Reform

At the time of the Tithe Commutation Act of 1836 the tithe was a complex tax that only about 70 percent of farmland in England was still subject to. Further the tithe was collected fully on only some of this 70 percent. The tithe was a tax originally levied as one-tenth of a farmer's gross produce in support of the local church back before the middle ages. Tithe law established that tithe could be collected on intermediate inputs produced on the farm such as seed grains, hay fed to animals, and lambs kept for fattening. In practice tithe owners found it much more convenient to negotiate with farmers each year for a monetary payment in lieu of physical collection of the tithe. Milk from cows, for example, would have to be collected each day at the farm. Grain was by custom collected unthreshed in the fields, and would have to be stored and threshed by the tithe owner who collected in kind. But this substitution produced much bargaining between tithe owners and farmers since there was a substantial gap between what the physical collection of the tithe would have cost the farmer and what it was worth to the tithe owner. The farmer who paid in cash would typically negotiate a discount of between 25% and 50% compared to the value of the product collected in kind (Evans (1976), pp. 23-5). Thus though tithe collected fully would have been equivalent to about 25% of the rental value of land in the nineteenth century the actual amounts paid tended to be smaller. On charity owned lands in the early nineteenth century the actual payments averaged only 11% of the rental value.

At the time of reform only some lands were effectively subject to tithe for four different reasons. First some areas, which were extra parochial, never had tithe obligations. Second, as a result of the reforms of Henry VIII, some of the right to collect tithe fell into private hands. Indeed it is estimated that by the seventeenth century one third of all tithe was owned by laymen.⁵ These private owners then sometimes sold the right to collect tithe to the landowners, abolishing the tithe through “unity of possession.” Third, in other areas the tithe owners back in the medieval period agreed with landowners to collect a fixed sum per year in place of the tithe, this sum being called a “modus.” This effectively turned these tithe obligations into a fixed payment on the site value of the land. Finally in the eighteenth century much land that had common rights attached was converted into purely private property in a process known as the Enclosure Movement. At the time of enclosure the tithe owners were often given land in exchange for their tithe rights, making all the land involved now tithe free.⁶ Table 1 shows for the counties used in this study the share of land in rural parishes that actually paid tithe in 1836 at the time of the reform. Figure 3 shows the geographic location of the counties used in the study. As can be seen, they were spread across England.

The tithe imposed social costs in three ways. Most importantly it distorted production choices by farmers towards outputs where the tithe burden was lighter. In practice the tithe burden on land growing grains was much heavier than on land producing pasture products such as milk or cheese.⁷ Grains were harvested at one time in the late summer, and the amount harvested could be easily observed by the tithe collector. But with products such as milk, cheese, butter, eggs, and poultry, produced throughout the year, and some of which were consumed on the farm by the farmer and his workers, observing the actual amount of production was impossible, so that tithe was widely evaded. Secondly the gap between the cost of the tithe collected in kind to the farmers and its value to the receivers left plenty of room for dispute and bargaining. Resources were thus devoted by farmers to negotiating to minimize their tithe burdens, and even to litigating in court the extent of the burden. Finally the tithe discouraged investment in capital by farmers and landowners, by increasing the required rate of return. Consequently, tithe reform was a major political issue in the late eighteenth and early nineteenth centuries. The courts were besieged with tithe cases involving accusations from both sides. This discontent led to confrontations and even violence whose solution was to be the Tithe Commutation Act of 1836.

⁵ Evans (1985), p. 389.

⁶ See Evans (1976) and Kain & Oliver (1995) for a more detailed account of tithe commutation prior to 1836.

⁷ When land with common rights was enclosed by Parliament in the years 1750-1835 the tithe right was often eliminated in favor of giving the tithe owner a share of the land. For arable land the accepted share was one fifth. But for pasture it was sometimes as little as one eighth. Evans (1976).

Table 1: Share of Area in Rural Parishes Paying Tithe in 1836

County	Area in rural parishes (acres)	Area Paying Tithe (acres)	Fraction of Land with Tithe
Bedford	249,195	75,200	.30
Berkshire	293,724	252,890	.86
Buckingham	310,389	123,480	.40
Cambridge	453,288	272,172	.60
Cheshire	418,715	404,625	.97
Cornwall	612,750	610,950	.99
Cumberland	415,815	184,100	.44
Derby	330,480	227,244	.69
Devon	1,358,774	1,326,580	.98
Dorset	456,436	414,920	.91
Durham	283,822	258,645	.91
Essex	787,449	749,844	.95
Gloucester	469,040	293,656	.63
Hampshire	568,260	536,154	.94
Hereford	418,760	390,816	.93
Hertford	216,376	171,792	.79
Huntingdon	210,574	80,262	.38
Kent	709,198	691,920	.98
Lancaster	497,564	398,524	.80
Leicester	371,246	117,012	.32
Lincoln	1,331,622	512,160	.39
Monmouth	229,056	216,318	.94
Norfolk	906,288	861,168	.95
Northampton	535,458	135,346	.25
Nottingham	378,000	141,298	.37
Total	13,154,400	9,631,048	.73

Note: Parishes were counted as rural if they had at least 70% of property rental values coming from land in 1842.

Source: Kain & Oliver (1995)

Figure 3: The Counties used for Estimating the Effects of the Tithe Reform



The Commutation Act set up the Tithe Commission, which over the next twenty years supervised the transformation of all remaining tithes into a lump sum charge independent of the future course of cultivation or fertility of the land. This lump sum was indexed to agricultural prices in general, but was in no way linked to the future productivity of the land. By the law the tithe payment for each parish was fixed as the average of the amounts actually paid for tithe in the seven years 1829-1835. That total payment was then apportioned among the various fields of the parish or township.⁸ The apportionment was made by determining the rental value or corn yield of each field in the parish. This meant that until the apportionment was made, the disincentives of the tithe system were still in force for landowners and farmers.⁹ However, once the tithe charge was apportioned, the marginal tax rate from the tithe dropped to zero and the potential for distortion disappeared. The complexity of the apportionment process meant that it took years for it to be completed for all affected parishes. In particular nearly a third of English parishes were not apportioned till 1842 or later.

Some parishes and landowners would have been unaffected by the Tithe Commutation Act of 1836 as their land was already tithe-free or paid tithe in the form of an unchangeable modus at the time of the Act. Therefore the Commutation Act should have driven up the rental value of land in the parishes which were affected relative to the unaffected. This is what allows us below to estimate the efficiency costs of the system of taxation of gross output under the old tax system.¹⁰

4. Method of Estimating Gains from Tax Reform

The social cost of the tithe was the amount it cost to raise each pound of revenue through the tax. If the tax created no distortion of farmers' production choices, no commitment of resources to bargaining over the payments, and no reduction in farmers or landowners' investment, then the cost would be zero. If however, there was a cost associated with taxing gross output, the gains from reform will be measurable as the relative increase in rents for the reformed parishes. That is, once free from the disincentive effects of the tithe, if farmers changed their production choices and/or if landowners invest in more land improvements then the resulting gains in output above the cost of inputs will show up as rent gains.

For England we have observations for 1842, when the Property and Income Tax was reinstated, for each parish in the country on the rental value of land, tithes, houses, and commercial property. We also have the amounts that property occupiers paid in local taxes, principally taxes to support the poor in each of the years 1838-41. For 1855 we have equivalent information for each parish on just the total rental value of the parish (including the new tithe rent charge after apportionment) and the amount paid in local taxes. We confine ourselves in measuring the effects of tithe reform to rural parishes,

⁸ See Kain & Prince (1985) and Kain & Oliver (1995) for a more detailed account of this process.

⁹ This was the case only for those parishes still making tithe payments that were dependent on the produce of the land.

¹⁰ A potential endogeneity problem exists if parishes that earlier reformed the tithe are unobservably different than parishes that reformed after the Act in a way that is related to the rental value of land.

defined as those where at least 70% of the rental value of property in 1842 was from land, since the tithe in practice was not collected from urban property owners.

Let $land_i$ be the land area of parish i , and $house_i$ be the number of houses, assumed unchanged between 1842 and 1855. Further assume that the total rental value of each parish in 1842 is given by

$$V_{i,1842} = \lambda_{1842} land_i + \phi_{1842} house_i + u_i + e_{i,1842} \quad (1)$$

where λ_{1842} is the average rent, tithe and taxes paid per acre of farmland in 1842, ϕ_{1842} is the average rent and taxes per house in 1842, u_i is a fixed rent premium or disadvantage this parish has relative to the average, and $e_{i,1842}$ is any random factor affecting rents in 1842. The corresponding expression for 1855 will be,

$$V_{i,1855} = \lambda_{1855} land_i(1 + \theta f_{tithe}_{i,1842}) + \phi_{1855} house_i + u_i + e_{i,1855} \quad (2)$$

where f_{tithe} is the fraction of land in the parish which had the tithe made into a lump sum between 1842 and 1855, and θ is the percentage gain in rent to each acre paying tithe. This implies that the change in the total rental value of a parish between 1842 and 1855, ΔV , will be

$$\Delta V_i = \Delta \lambda land_i + \lambda_{1855} \theta land_i f_{tithe}_{i,1842} + \Delta \phi house_i + \Delta e_i \quad (3)$$

Dividing each side by the value of land in the parish in 1842 gives us

$$\frac{\Delta V_i}{\lambda_{1842} land_i} = \frac{\Delta \lambda}{\lambda_{1842}} + \left(\frac{\lambda_{1855}}{\lambda_{1842}} \right) \theta f_{tithe}_{i,1842} + \frac{\Delta \phi}{\phi_{1842}} \frac{\phi_{1842} house_i}{\lambda_{1842} land_i} + \Delta \varepsilon_i \quad (4)$$

This is the basic equation we estimate. The estimated value of θ will be the percentage gain in land rent (including tithe and tax payments) from having an acre of land freed from tithe. If the tithe had no distortionary effect then θ will be zero.

The actual equation estimated is¹¹

$$\Delta GR = \alpha + \beta FTITHE_{1842} + \gamma FHOUSE_{1842} + \sum \omega_j CONTROL_j + \varepsilon \quad (5)$$

where ΔGR is the change in the total value of rents and taxes in a parish from 1842 to 1855 divided by the rental value, tithe, and taxes paid by farmland occupiers. $FHOUSE$ is the share of the total value of rents, tithes and taxes in a parish attributable to houses in

¹¹ Where $\alpha = \Delta \lambda / \lambda_{1842}$, $\beta = (\lambda_{1855} / \lambda_{1842}) * \theta$, and $\gamma = \Delta \phi / \phi_{1842}$

1842.¹² $CONTROL_j$ are a set of control variables to allow for other influences on the change in total rental values in a parish between 1842 and 1855. The estimated value of α will be the average percentage change in farmland rents, tithe and taxes from 1842 to 1855 on tithe free land. The estimated value of γ will be the average percentage change in house rents and taxes from 1842 to 1855. If the tithe had no efficiency cost then β will be estimated to be 0.

The rental values for land and houses measured by the tax authorities in 1842 were by law the minimum of the current rental value or the value on a lease established within the last seven years. That means that if the tithe was reformed in 1838 then still in 1842 there would be some land in the parish that was quoted at a rent established before the tithe reform. Thus we modified the basic equation above to

$$\Delta GR = \alpha_0 + \beta_1 \Delta FTITHE_{1836-1840} + \beta_2 \Delta FTITHE_{1841-1854} + \gamma FHOUSE_{1842} + \sum \omega_j CONTROL_j + \varepsilon_i \quad (6)$$

$\Delta FTITHE_{1841-1854}$ is the amount of tithe reformed between 1841 and 1855.

$\Delta FTITHE_{1836-1840}$ is the amount of tithe reformed between the Tithe Commutation Act of 1836 and 1841. If there is an efficiency loss from the tithe then β_1 should also be positive, but of smaller magnitude than β_2 .

To control for other influences on the movement of rent between 1842 and 1855 we include an indicator variable for the county each parish was located in, variables for the parish soil type, the rate of population growth in the parish between the years 1801-1841 (as a measure of urbanization), the fraction of land transferred from common ownership to pure private property in the years 1842 to 1855, the average height of the region the parish was located in, and the difference between the minimum and maximum height.

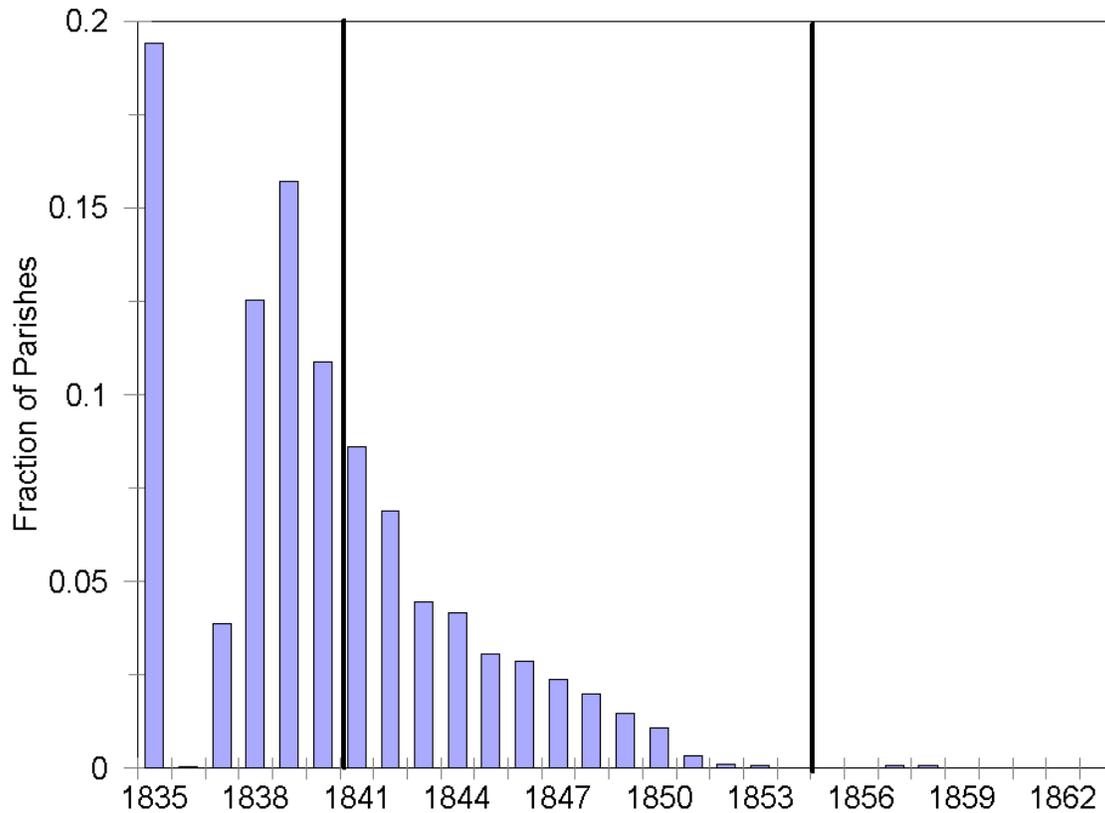
5. The Parish Sample

The data for this estimation comes from a sample of 5,422 parishes and townships from 25 counties (out of 42 in England). These parishes represent about half the number potentially available for the estimation. Parishes were included in the sample if at least 70% of the rental value of property in 1842 was from land and tithes. In the average parish in the sample 91% of rental income came from land as opposed to housing. Since there were some property values recorded for 1842 or 1855 that seemed implausibly high or implausibly low, given the rural nature of the sample, we excluded observations under two conditions: where the land value more than doubled between 1842 or 1855, or fell to less than half its 1842 level by 1855, and where the rent per acre exceeded £5 in either

¹² The assessed property value also includes mines, quarries, canals, railroads and a few other minor categories. These categories will not enter into the analysis as most parishes with non-negligible amounts of these types of rents have been dropped from our sample due to our restriction that land values account for at least 70% of total property value thus insuring that we are focusing on rural/agricultural parishes.

year (the average rent being £1.6 per acre).¹³ The counties were chosen for coding by alphabetical order, and show a fair sampling from the various regions of England. Figure 4 shows the fraction of parishes with tithe commutation by date. As noted, in many parishes the tithe had been wholly or partly bought out or converted into a fixed charge on the land by 1836. Thus 19% of our sample is listed with a tithe reform date of 1835. These parishes represent our “control” group on the effects of the tithe reform.¹⁴

Figure 4: Fraction of Parishes with Reform by Year



Notes: Parishes listed under “1835” had no tithe by the time of the Tithe Commutation Act in 1836.

Source: Kain and Oliver (1995).

¹³ 106 observations were excluded because of this restriction, 67 where the rental value of property in the parish more than doubled from 1842 to 1855, and 39 where the property rental value fell to less than half. When we estimated the regressions with these observations included it made little difference to the point estimates but increased the standard errors by about 50%.

¹⁴ The 1835 coding was merely a convenience to indicate the reform took place prior to 1836. The actual dates of commutation of the tithe in these parishes would vary.

The other parishes, the “treatment” group, vary widely as to the date the commutation achieved, with a few not even completed until the 1860s. Since some land in the 81% of parishes that had some tithe payment in 1836 was already tithe free the division here into control and treatment groups is not quite so neat. In the regressions we use a measure of the tithe status, *FTITHE*, that will vary from 0 to 1 across parishes at any time depending on the amount of land that experienced tithe reform.

Table 2 displays summary statistics on the variables of interest for our treatment and control groups. The rental value of all property in each parish was reported for both 1842 and 1855 as well as local taxes paid by property occupiers. We also have from the British decennial census populations for these parishes in 1801, 1831, and 1841, as well as the land area of the parish. From printed county directories in the late nineteenth century we get information on the soil composition of each parish. Enclosure information comes from a volume compiled from local sources on Parliamentary Acts of Enclosure by Tate. The elevation information is for agricultural areas defined by a later climate survey of Britain. All the data sources are described in detail in the appendix.

There are some statistically significant differences between the control and the treatment parishes as the table shows. The major way in which tithe was removed before the Tithe Commutation Act in 1836 was through the enclosure (privatization) of common lands in parishes. Such common lands were found only in some areas of the country. These areas had parishes with somewhat different characteristics. Thus parishes without tithe by 1836 tended to be a little smaller, with a larger fraction of clay soils, at a lower elevation, and with less likelihood of remaining common land in 1836. In 1842 parishes without tithe have a statistically significant higher property rental value per acre. But by 1855 once almost all the tithe was made into a lump sum payment the value differences had disappeared. Given these differences between early and later reforming parishes we control for as many of these differences as possible in our regression analysis.¹⁵

Table 3 gives difference in difference calculations for various breakdowns of our treatment and control groups. Here we see an obvious difference between early and late reforming parishes with rents declining more between 1842-55 where the tithe system was reformed before 1836.

¹⁵ Controlling for as many differences as we can will ease (but not eliminate) the endogeneity concerns raised earlier.

Table 2: Differences Between Treatment and Control Parishes

Variable	Tithe in 1836 Mean	No Tithe 1836 Mean	Difference of means	Standard Error
Value per Acre (£) 1842	1.61	1.68	-.070**	.023
Value per Acre (£) 1855	1.58	1.56	.020	.023
Population 1801	362	339	23*	10.1
Population 1831	487	462	25	14.5
Population 1841	520	501	19.0	15.8
Land Area	2483	2287	196**	64.1
% Topsoil Heavy Clay	4.9	7.4	-2.5**	.008
% Topsoil Clay	22.3	31.4	-9.1**	.013
% Topsoil Gravel	6.9	10.9	-4.0**	.009
% Topsoil Chalk	4.5	5.0	-0.5	.006
% Topsoil Sand	14.4	10.6	3.8**	.009
% Topsoil Loam	20.3	18.6	1.7	.011
% Topsoil Fertile	5.8	8.3	-2.5**	.009
Average Elevation (Meters)	85.9	79.3	6.6**	1.55
Range of Elevation (Meters)	232.9	194.4	38.5**	4.06
% Area Enclosed, 1841-1854	1.4	0.4	1.0**	.002
% Area Enclosed, pre 1836	12.2	57.4	45.2	

Notes: There were 4,370 parishes still with at least some tithe payments in 1836 in our sample, and 1,052 without tithe in 1836. Statistical significance: * = 5%, ** = 1%.

Table 3: Differences in Differences

Group (by date of Tithe Reform)	Observations	Value per Acre 1855	Value per Acre 1842	Difference	Difference in Differences
Before 1836	1,052	1.56	1.68	-.125	
1836-1840	2,332	1.59	1.63	-.040	.085** (.013)
1841-1854	2,029	1.56	1.59	-.032	.093** (.013)

Notes: Standard errors are reported in parentheses. Statistical significance: * = 5%, ** = 1% .

6. The Regression Estimates of the Effect of the Tithe Reform

To control for any potential differences in the early and late tithe reformers the basic equation we estimated was (6)

$$\Delta GR = \alpha_0 + \beta_1 \Delta FTITHE_{1836-1840} + \beta_2 \Delta FTITHE_{1841-1854} + \gamma FHOUSE_{1842} + \sum \omega_j CONTROL_j + \varepsilon \quad (6)$$

The estimation results from this equation with various different controls are reported for each of these divisions in table 4.

Column 1 shows the results of the estimation of equation (6) above with no controls, while Columns 2-4 explore the robustness of the result to including county level fixed effects, and additional control variables. Without controls the effect of tithe reform is positive and statistically significant for both groups of reforming parishes with those who experienced the reform in 1841 to 1854 seeing a larger effect on the rent change than those that experienced commutation in 1837-1840, though the point estimates across these two groups are not statistically different. The estimated coefficient for the variable *FHOUSE* is positive and statistically significant. The estimated coefficients for α and γ are -0.106 and 0.092 suggesting that land rents on average fell by 11% from 1842 to 1855 while house rents rose 9%.¹⁶

Adding just the county level fixed effects as in column (2) reduces the point estimates of the effects of tithe reform modestly but the reform still has a quantitatively and statistically significant positive effect. The estimates reported in column (3) include a variable $\Delta FENC_{1841-1854}$ that measures the fraction of the land in a village that experienced termination of common rights by act of Parliament in the years 1841 to 1854. The coefficient on this variable is significant both quantitatively and statistically. Enclosing land in this way led to substantial rent gains. Since parishes experiencing tithe reform were more likely to experience enclosure than those whose tithe had already been commuted, including this variable modestly reduces the estimated effects of the tithe reform on rents.¹⁷

Column (5) reports the results of the estimation when all the potential control variables are added, including population growth from 1801 to 1841 (as a measure of urbanization or proximity to an urban area) soil types, and measures of topography. The estimated effects of tithe reform are robust to inclusion of these controls. The parishes which had the reform between 1841 and 1854 also saw a larger gain in rents from 1842 to 1855 than those which experienced the reform from 1836 to 1840, though the difference between

¹⁶ The British introduced free trade for food imports in 1846 leading to reductions in the real prices of agricultural output. The interpretation of γ as suggesting a 9% increase rents assumes the number of houses on average did not change.

¹⁷ Clark (1998) using a different data set on the rental value of charity plots finds a quantitatively similar effect of enclosure on rents in the years before 1840.

these coefficients is not statistically significant. Given the estimate of α of -0.106 , our estimate of θ_2 is $(0.066/.894) = 0.074$.

Table 4: Measuring the Effect of Tithe Reform on Δ Property Values 1842-55

Independent Variable	2	3	4	5
Tithe Reform 1836-40	.058** (.008)	.051** (.010)	.046** (.010)	.047** (.010)
Tithe Reform 1841-54	.074** (.008)	.070** (.010)	.064** (.010)	.066** (.010)
Ratio of Property Rental from Houses to Land, 1842	.150** (.032)	.125** (.034)	.119** (.034)	.092** (.035)
Fraction Area Enclosed 1841-54			.177** (.039)	.175** (.039)
% Δ Population 1801-41				.024** (.007)
Fraction of Soil Heavy Clay				-.019 (.016)
Fraction of Soil Clay				.001 (.010)
Fraction of Soil Gravel				-.003 (.015)
Fraction of Soil Chalk				-.024 (.020)
Fraction of Soil Sand				.013 (.012)
Fraction of Soil Loam				-.015 (.011)
Fraction of Soil Fertile				-.027* (.014)
Average Elevation				-.0003* (.0001)
Maximum – Minimum Elevation				.0001* (.00006)
Constant	-.087 (.007)	-.091 (.022)	-.094 (.022)	-.106 (.025)
Cnty Fxd Effcts	No	Yes	Yes	Yes
R Squared	.019	.047	.050	.056
F	35.21	6.77	7.14	6.31
N	5,422	5,422	5,422	5,398

Notes: The dependent variable is the change in parish rental value relative to land values 1842-1855. Standard errors are reported in parentheses. Statistical significance: * = 5%, ** = 1% .

Table 5: The Gains from Tithe Reform in the South versus the North.

Independent Variable	5
Tithe Reform 1836-40, North	.011 (.026)
Tithe Reform 1836-40, South	.053** (.011)
Tithe Reform 1841-54, North	.035 (.026)
Tithe Reform 1841-54, South	.071** (.011)
Fraction Property Rental from Houses, 1842	.093** (.035)
Fraction Area Enclosed 1841-54	.171** (.039)
% Δ Population 1801-41	.024** (.007)
Constant	-.106 (.025)
Cnty Fxd Effcts	Yes
Soil, Elevation Controls	Yes
R Squared	.056
F	6.11
N	5,398

Notes: The dependent variable is the change in parish rental value relative to land values 1842-1855. Standard errors are reported in parentheses. Statistical significance: * = 5%, ** = 1% .

For England data from another source, the records of charity land holdings, shows that while on average in the years 1815-1844 the ratio of tithe to rental payments and tithe was 11.75%, in the southern part of England the average tithe collection was 13.5% of rent and tithe, while in the north it was only 6.5%. For historical reasons tithe was more lightly assessed in the north. Thus in table 5 we have reported estimates for the effect of tithe reform separately for north and south, on the grounds that the rent loss from the imposition of the tithe may have been greater in the more heavily tithed south.

7. The Potential Efficiency Losses from the Tithe

Using our estimate of θ_2 derived from the last column of table 4 we are now able to estimate the potential excess burden of the tithe in England in 1842. From equation (4) above our estimate of θ_2 shows the percentage increase in rents that results from changing the tithe into an equivalent lump sum tax. If all the costs of the tax to society took the form of switching output to less heavily taxed commodities, negotiating costs of

collecting the tax, and farmers investing less in working capital, then the loss to society in income for every £ collected will be

$$\frac{\text{loss}}{\text{tithe}} = \left(\frac{\text{loss}}{\text{rent}} \right) \bigg/ \left(\frac{\text{tithe}}{\text{rent}} \right)$$

where “rent” here includes rental payments, tithe and local taxes. Table 6 shows the elements of this calculation for the north of England, the south, and England as a whole. The calculated potential excess burden of the tax is similar in both areas, and comprises 63% of the income raised nationally.

Since in England about 20% of farmland rent was a payment for the fixed capital such as buildings rented with the land, the table here shows just the “potential” excess burden, because the rent gains from tithe reform may include gains from increased fixed capital investments. Since these investments have a cost, rent gains from this source are not part of excess burden. We cannot directly estimate this since no capital stock figures exist by parish for this period. But we can show by a simple calculation that reduced fixed capital investment is most likely less than half the potential excess burden here, so that the social costs of collecting the tithe were indeed large. If the production function in agriculture was Cobb-Douglas, which allows a lot of substitution between land and the other inputs, then the tithe imposed as a tax on gross output would have reduced the variable inputs such as labor and capital used in agriculture by 12%.¹⁸ In this case tithe reform would increase land rents by an amount equal to 26% of the tithe collected as a result of increased fixed capital investment. But since the easiest way to escape tithe was to change the composition of output, or bargain hard on the amount to be paid, we think that the great majority of the gain in rents from changing the basis of the tithe would be pure excess burden.

Table 6: The Potential Burden of the Tithe

Area	Loss/ Rent	Tithe/ (tenants' rent+tithe)	Local Taxes/ (tenants' rent+tithe)	Tithe/ (all claims on land)	Potential Burden (%)
North	.039	.065	0.064	0.061	64
South	.079	.135	0.084	0.125	63
England	.067	.114	0.078	0.106	63

¹⁸ Assuming the share of land site value in all costs was 32%.

8. Conclusion and Implications

The reform of the tithe in England and Wales in 1836 produced substantial rent gains relative to the amount of tax revenue collected: £0.63 was gained by landlords for every £1 previously collected in tithe. It is possible that some of this £0.63 came from increased fixed capital investments in farm buildings, fences, and drainage systems. But we expect most of it came from a socially more productive choice of outputs. It is also possible that those renting land found the tithe just psychologically burdensome. It was unpleasant to have to negotiate the burden with the tithe owner, so that farmers were willing to pay more in rent than they avoided in tithe for tithe free land. This suggests that designers of tax systems do have to be careful to create systems that do not make tax avoidance profitable for the taxed. But it also raises some questions. About a third of the right to collect tithe was privately owned by the seventeenth century. Why didn't these private owners agree to accept a fixed lump sum in lieu of tithe? Or why didn't they sell the tithe right to the landowner? Our results suggest that this would have been a profitable trade. But English courts before the Tithe Reform Act did not regard agreements to fix the tithe at some monetary amount as a binding agreement, unless it had stemmed from medieval times. Thus the only way to eliminate tithe before 1836 was for the owner of the land to purchase the tithe right. For ecclesiastical tithe owners there were legal impediments to such sales, since the current occupant of the position could not alienate the property. Only private owners of tithe could have eliminated tithe payments before 1836. Some of them did sell the tithe right, but the procedure was by no means common.

The English experience of tithe reform, though it stems from the somewhat different conditions of the nineteenth century, does also imply that reforming land taxation practices in poorer countries where taxes on farm output are still an important source of revenue might have significant social gains.¹⁹ Outside India, where this form of taxation was heavily influenced by British rule before 1947, such forms of taxation of agriculture have been rare.

¹⁹ Hoff (1993) argues against such taxes on grounds of the risk aversion of cultivators in low income societies. Fixed taxes, she argues, impose more income variation on cultivators than taxes based on the value of output. This assumes, however, that the cultivators are also the land owners, which will often not be the case.

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