DEATH AND TAXES: THE DRIVERS OF ECONOMICS GROWTH

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SUMMARY
We show that in a Malthusian world an increase in taxes raises average labour productivity by culling marginal workers and reducing equilibrium population. Thus states with higher taxes will have higher labour productivity, ceteris paribus, and an increase in taxes in a particular state will generate an increase over time in labour productivity ("economic growth"). Landowners create the same effect by extracting agricultural surplus from workers. Differential tax regimes and landownership structures can thus explain Europe's labor productivity advantage over China in the eighteenth century. We test the model directly on a cross section of Chinese provinces and European states for c. 1775.

KEYWORDS
Malthusianism; economic growth; tax policy; institutions

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1 Introduction

Data presented by Angus Madison (2000) suggest that there were very substantial cross-country variations in output per head long before the advent of modern economic growth. Indeed, long before colonization and even before there were significant volumes of inter-continental trade. Revisionists such as Robert C. Allen (2004a, 2004b, 2005), Bozhong Li (1998), Presannan Parthasarathi (1998) and Kenneth Pomeranz (2000) have countered that parts of India and China were as economically advanced as Western Europe. They believe that this is important because they infer from this observation that India and China may have been as likely as Northwest Europe to industrialize around 1800, thus setting world history on a very different path. By contrast, Liam Brunt and Antonio Fidalgo (2011) present an entirely new data set on international agricultural productivity between 1700 and 1870, which reveals even more significant variation across countries and over time than that previously estimated by Madison. This reinforces the view that European exceptionalism was not accidental but, instead, founded on longstanding and deep-rooted economic differences. But, if we accept the evidence of both Madison and Brunt and Fidalgo, then how can we explain the observed pattern of productivity variation? What were the economic or political or geographical drivers that generated these divergent outcomes across the globe? Could the world plausibly have turned out differently, as the revisionists like to argue? We believe not.

In this paper we start out from a Malthusian model of population. Ever since the Reverend Thomas Malthus (1798) first set out his model, it has been widely accepted as a broadly accurate description of the population regime of the pre-industrial world. Workers survive and procreate when they are well fed; and, the better fed they are, the more they procreate and the longer they survive. These effects push up population and put pressure on natural resources. In particular, reducing the quantity of agricultural land per worker so that workers will be less well fed in the future. As a result, procreation falls and mortality rises until the population returns to its stable long run relationship with natural resources. The long run relationship can be altered only by changes in agricultural or (perhaps) industrial technology.

Our first innovation is to introduce government into the Malthusian model, in the form of taxation. Raising taxes reduces the food budget of workers, pushing up mortality and curtailing procreation. This raises the average level of labor productivity by removing marginal workers from the population. Thus high taxes generate economies with high labor productivity; and tax increases generate improvements in labor productivity. This is "economic growth" in one of the senses that it occurs in the Solow model a traverse from one equilibrium to another equilibrium with higher output per worker. Our second innovation is to introduce landowners into the model, showing that they accentuate the positive productivity effect by extracting some of the agricultural surplus in the form of rent, which they consume to maintain their existence.

We test the model using data from c. 1775 on tax burdens and the land-labor ratio, both within countries (Chinese provinces) and across countries (China and Europe). We find that the predictions of our model are born out by the data: workers who were highly taxed enjoyed higher land-labor ratios. We further show that the land-labor ratio was the key determinant of labor productivity differentials.
The paper proceeds as follows. In section one we offer a brief comparison of China and Europe, highlighting the key institutional differences. Section two describes a simple Malthusian economy and shows what happens when we introduce taxes and landowners. In section three we present evidence on taxation and land-labor ratios, as well as land-labor ratios and labor productivity. Section four concludes.

2 Historical setting and motivation.

Historically, a prominent aspect of European society has been the existence of a landowning class. It was typically not the case that European peasants owned the land themselves, either in severalty or in common. Rather, the land was owned by a relatively small number of individuals or families who did not cultivate the land directly but instead rented it out to peasants who cultivated it; this rent could take the form of labor services (as it did under feudalism) or money (as it did under the later, market economies). To the extent that landowners were required to do anything in return for owning land, it was typically waging war on behalf of the monarch. This is exactly why feudal lords were allocated landed estates; it gave them the means, and the obligation, to provide a certain number of trained soldiers when the king demanded it. Even when the feudal system fell into abeyance in the modern period, it was still the landowners who provided military finance (through the land tax) and officer manpower (through the enlistment of younger sons).
This landowning class was entirely absent in China. The first Emperor, Qin Shi Huang, established himself in power in 221BCE after his military victories brought an end to the Warring States period. Having achieved victory, the Emperor promptly executed the landlords because he did not need them any more (the war was over and a new administration, based on civil servants, could collect taxes in their place), and because the landlords were a threat (they created a possibility of further rebellion because the soldiers owed allegiance to their landlord, rather than the emperor). Through succeeding dynasties, nobility became restricted to members of the ruling house and noble titles became purely honorific. In the absence of a landowning class, the majority of land in China was owned directly by peasant agriculturalists, who in turn paid taxes directly to the government.
We believe that the existence of a landowning class in Europe was crucial. The landowners' desire to increase their income (i.e. the agricultural surplus that was generated on their land) prompted them to raise rents and impoverish the peasants; this prevented excessive population growth. "Excessive" population is defined here as workers whose marginal product is less than their subsistence

consumption. In a Malthusian world, the marginal workers consume more than their marginal product; this is because they have a negative externality on the existing workforce. One can think of this as a tragedy of the commons: more workers come to work in the fields until the whole of the food output is consumed by the workforce. Even though the marginal workers consume more than they produce, they can exist because the total output is shared equally between all the workers; this process of immiseration can only stop (in equilibrium) when the land cannot physically feed any additional workers. In technical economic terms, in a Malthusian economy the average product per worker equals the subsistence level of consumption. Introducing profit-maximizing landowners moves the economy to a new equilibrium where the marginal product per worker equals the subsistence level of consumption.

For clarity, in this paper we leave aside any managerial or capital inputs that landowners might have provided. We model the landlords purely as rentiers in the strict sense of the word (i.e. they absorb surplus produced by the workers —net of taxes— in return for letting the workers cultivate the land). Of course, we could introduce into our analysis additional benefits that accrue to having a landowning class such as superior technical knowledge or managerial expertise, or a willingness to experiment. These would increase the productivity benefit of having a landowning class and help to explain the productivity differential between China and Europe. We believe that these aspects may also have been historically important, and elsewhere we have considered the role of new technology in raising productivity, as well as how that new technology was generated (Brunt, 2003, 2004). But here we want to focus exclusively on the positive labor productivity effect of moving to a new population equilibrium in a simple Malthusian setting. We want to demonstrate clearly that, even if landlords made no special contribution to technological progress or superior management, their economic incentives and power to extract rents alone were sufficient to raise productivity.

We have already alluded to another key difference between China and Europe. China was essentially at peace after 1644, whereas Europe was continually at war. The Qing dynasty Emperors therefore had only a very modest need to levy taxes, whereas European powers were in a constant struggle to obtain sufficient tax revenue. Hence most European monarchies defaulted on multiple occasions in the seventeenth and eighteenth centuries. In section N we provide a comparison of the tax burdens in China and England around 1775, revealing that the burden per worker was around 25 times larger in the England.

An important similarity between China and England is that the vast majority of tax was levied on land (as opposed to being levied on output or labor, for example). China had started out by taxing both men and land; this made sense because the tax on men was originally in the form of labor services and the tax on land in the form of food. But both taxes were soon commuted into money equivalents, which was more convenient for both the taxpayer and the tax collector; then, from the late sixteenth century onwards, the tax on men became increasingly rolled into the land tax. For example, it became standard to assume a certain number of men per unit of land. This became known as the "Single Whip" method of taxation. As we show in the following

section, how taxes are levied can have important consequences on the incentives of landlords to produce output and hence set equilibrium population. Land taxes are the least distortionary tax instrument, which is socially and privately optimal; hence the reliance on a land tax in China and England was beneficial. But a significant difference between China and continental Europe (as well as some parts of England) is that European countries levied a ten per cent tax on output the tithe. This makes it optimal for landlords to reduce output, ceteris paribus. This further reduces the equilibrium level of population: now, not only do landlords seek to reduce population in order to generate output most efficiently, but they also reduce their equilibrium output. Hence there are two negative effects on the size of the population. We further consider the distortionary impact of an output tax in the next section.

3 The model

3.1 The production function

Consider an agricultural Cobb-Douglas production function with two factor inputs, Land (L) and Workers (N_A), and one single output, food (Y)

$$Y = AN_A^{\alpha}\bar{L}^{1-\alpha} \tag{1}$$

where A is a productivity parameter, the subscript A stands for agricultural population and the bar over the L refers to the fact that the quantity of land is given.

3.2 The Malthusian economy without landowners

"The defining characteristic of a Malthusian phase in economic development is that there is no long run trend growth in real wages. Improvements in productive potential are swallowed up by population growth. At the same time population growth is regulated by a preventive check on fertility and a positive check on mortality such that a homeostatic equilibrium is maintained." (Crafts, N. and T. Mills (2007)) Thus total output is just sufficient to feed the population. This implies that

$$Y = f(N_A, \overline{L}) = \underline{c} \cdot N_A$$

where $\underline{c}$ is the consumption at the subsistence level (that is, the level that just allows people to work enough to feed themselves and not die prematurely). Since the marginal productivity of labor is decreasing for a given quantity of land, the productivity of the last (marginal) worker will be lower than the average (even though workers are homogeneous), $\underline{c}$.
We do not model population dynamics because we are essentially interested in contrasting the various long run equilibria. But we can say that the growth rate of population depends on $(c - \underline{c})$ and it is equal to 0 at equilibrium. Suppose that there is an adverse shock to the economy. Then the marginal product of the last worker on the field will increase, and so will the average product. By

the population dynamics that we postulate for this economy, the population will increase until it reaches back the equilibrium level which prevailed before the shock.

3.2.1 Equilibrium population and productivity without a government

In absence of landowners, the total production is shared among the agricultural population. Consider each share as a wage, which is given by

$$w_0 = \frac{AN_A^{\alpha}\bar{L}^{1-\alpha}}{N_A} = A\left(\frac{\bar{L}}{N_A}\right)^{1-\alpha} \tag{2}$$

At equilibrium, the Malthusian population dynamics we postulate imply that every agricultural worker consumes food at the subsistence level $\underline{c}$. Therefore

$$w_0 = \underline{c} \tag{3}$$

From equations (2) and (3) we can deduce the equilibrium population level in absence of property rights

$$N_{A,0} = \left(\frac{A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{4}$$

3.2.2 A proportional tax on production/consumption

We assume that, if present, the government's goal is to maximize tax revenue (if only to waste it). Suppose that the government collects a proportional tax on production, $\tau < 1$, (and wastes the tax revenue τY). The disposable production is again shared by the agricultural workers. Each share is *de facto* the worker's wage, w_τ, which is given by

$$w_\tau = \frac{(1-\tau)Y}{N_A} = \frac{(1-\tau)AN_A^{\alpha}\bar{L}^{1-\alpha}}{N_A} = (1-\tau)A\left(\frac{\bar{L}}{N_A}\right)^{1-\alpha} \tag{5}$$

The same Malthusian population dynamics argument implies that this wage will be driven down to $\underline{c}$. Therefore, we can express the equilibrium population level which is compatible with a production taxation scheme

$$N_{A,\tau} = \left(\frac{(1-\tau)A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{6}$$

Suppose that the government seeks to maximize tax revenue. It's program will simply be

$$\max_{\tau\in[0,1]} T_\tau = \tau A N_{A\tau}^{\alpha}\bar{L}^{1-\alpha} \tag{7}$$

$$\text{s.t. } N_{A,\tau} = \left(\frac{(1-\tau)A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{8}$$

and the F.O.C. yields

$$\tau^* = 1-\alpha \tag{9}$$

Notice that if the government implements τ^*, the resulting equilibrium (agricultural productivity and population) is

$$N^*_{A,\tau} = \left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{10}$$

Tax revenue amounts to

$$T^*_{\tau} = (1-\alpha)\left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{11}$$

3.2.3 A lump-sum tax per head

Let each peasant be charged θ. Only available food can be shared by the peasants. Therefore,

$$w_\theta = \frac{AN_A^{\alpha}\bar{L}^{1-\alpha} - \theta N_A}{N_A} = A\left(\frac{\bar{L}}{N_A}\right)^{1-\alpha} - \theta \tag{12}$$

The implied population level is given by

$$N_{A,\theta} = \left(\frac{A}{\underline{c}+\theta}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{13}$$

In this case, the government program is

$$\max_{\theta} T_\theta = \theta N_A \tag{14}$$

$$\text{s.t. } N_{A,\theta} = \left(\frac{A}{\underline{c}+\theta}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{15}$$

and the solution

$$\theta^* = \left(\frac{1-\alpha}{\alpha}\right)\underline{c} \tag{16}$$

Again, if the government implements θ^*, the resulting equilibrium (agricultural productivity and population) is

$$N^*_{A,\theta} = \left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{17}$$

Tax revenue amounts to

$$T^*_{\theta} = \left(\frac{1-\alpha}{\alpha}\right)\underline{c}\left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{18}$$

Result 1 *In a Malthusian economy without landowners, both a proportional tax on production/consumption or a lump-sum tax per head reduce the population per unit of land.*

Since $(1-\tau)^{\frac{1}{1-\alpha}} < 1$, from (6) we have

$$N_{A,0} \quad > \quad N_{A,\tau} = (1-\tau)^{\frac{1}{1-\alpha}} N_{A,0} \tag{19}$$

Since $\left(\frac{\underline{c}}{\underline{c}+\theta}\right)^{\frac{1}{1-\alpha}} < 1$, from (13) we have

$$N_{A,0} \quad > \quad N_{A,\theta} = \left(\frac{\underline{c}}{\underline{c}+\theta}\right)^{\frac{1}{1-\alpha}} N_{A,0} \tag{20}$$

3.3 The Malthusian economy with landowners

3.3.1 Equilibrium population and productivity without a government

Now suppose that there are two sets of agents in the economy, Workers (N_A) and Rentiers (N_L). Workers rent the land and work on it. The product of the land (net of rent) is then shared equally among the workers on each unit of land. The rentiers seek to, and are able to, extract all the surplus.
If there are property rights over the land, but no taxes, then the landowners will hire workers at the market wage w_{PR}. Notice that perfect competition among the workers will drive the workers' wage down to the subsistence level, *i.e.*

$$w_{PR} \quad = \quad \underline{c} \tag{21}$$

Landowners maximize their rent R_L by solving the following program

$$\max_{N_A} R_L = A N_A^{\alpha} \bar{L}^{1-\alpha} - \underline{c} N_A \tag{22}$$

The FOC implies

$$w_{PR} \quad = \quad \alpha A \left(\frac{\bar{L}}{N_A}\right)^{1-\alpha} \tag{23}$$

Again, from (21) and (23) we can deduce the equilibrium population level in presence of property rights

$$N_{A,PR} \quad = \quad \left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}} \bar{L} \tag{24}$$

Result 2 *Other things equal, compared to a Malthusian economy without landowners, a Malthusian economy with landowners has a lower agricultural population per unit of land.*

$\alpha^{\frac{1}{1-\alpha}} < 1$ since $\alpha < 1$. Therefore, the result holds because

$$N_{A,0} \quad > \quad N_{A,PR} = \alpha^{\frac{1}{1-\alpha}} N_{A,0} \tag{25}$$

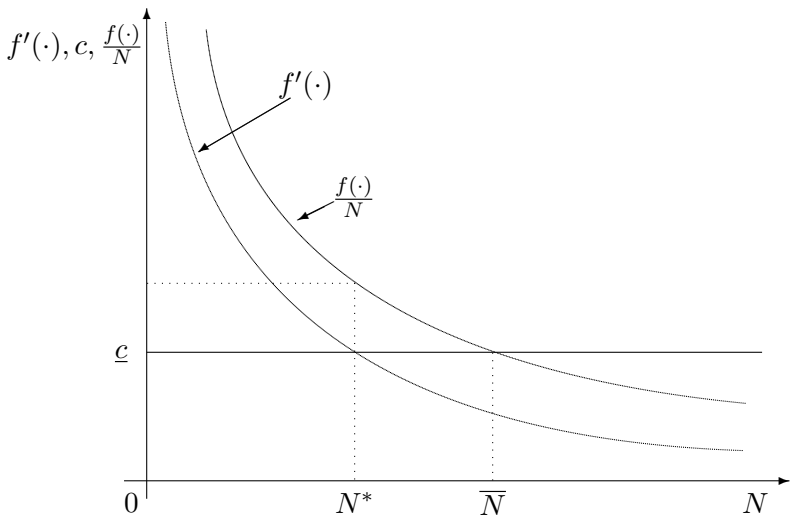

Figure 1: Determining equilibrium population

Result 3 *Other things equal, compared to a Malthusian economy without landowners, a Malthusian economy with landowners has a higher agricultural labor productivity.*

Labor productivity in the no landowners case is straightforwardly given by $\underline{c}$. With landowners, the labor productivity is equal to the total production divided by the number of workers

$$\frac{Y_{PR}}{N_{A,PR}} = \frac{AN_{A,PR}^{\alpha}\bar{L}^{1-\alpha}}{N_{A,PR}} = \frac{\underline{c}}{\alpha} \tag{26}$$

Again, the result holds because $\alpha < 1$.
This is really our key results. Labor is in free supply and the rentiers, who own the land, rent it to the workers. Therefore the rentiers are in a position where they can maximize their rent (i.e. the amount that they charge to the workers). In this case, rents are maximized at the point where the marginal revenue of the last worker is set equal to the marginal cost, $\underline{c}$. Therefore, in equilibrium, the population level will be lower - and output per worker higher - with than without rentiers. Figure 3.3.1 depicts the situation with and without rentiers.

3.3.2 The rent and the number of landowners

As it is well known with an homogenous of degree one Cobb-Douglas production function, the factor share remuneration is given by the exponent on that factor. Therefore, the landowners rent is given by

$$R_L = (1-\alpha)Y \tag{27}$$

Alternatively, the rent can be found by solving the program in (22) and then substituting in the solution (24). We have

$$R_L = (1-\alpha)\left(\frac{\alpha A}{\underline{c}}\right)^{\frac{\alpha}{1-\alpha}} A\bar{L} \tag{28}$$

With regard to the number of landowners, we consider two cases. Either the landowners population is exogenously fixed, i.e.

$$N_L = \bar{N}_L \tag{29}$$

or its number is determined in the model after making an assumption on the consumption of each landowner. For instance, the maximum number of landowners is found by imposing their consumption to be also at the subsistence level $\underline{c}$. Then, we have

$$N_L = \frac{R_L}{\underline{c}} = \frac{1-\alpha}{\alpha}\left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}}\bar{L} \tag{30}$$

3.3.3 A lump-sum tax on the landowner

In the case of a lump-sum tax on the rent, the landowners' program (as a whole) becomes

$$\max_{N_A} R_{L,\theta_R} = AN_A^{\alpha}\bar{L}^{1-\alpha} - \underline{c}N_A - \theta_R N_L \tag{31}$$

Notice, however, that the equilibrium population level in presence of property rights is the same with or without the lump-sum tax on the rent.

$$N_{A,PR,\theta_R} = \left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}}\bar{L} \tag{32}$$

If the government charges θ_R on each landowner, its program is

$$\max_{\theta_R} T_{\theta_R} = \theta_R N_L \tag{33}$$

$$\text{s.t. } c_L \leq \frac{AN_{A,PR,\theta_R}^{\alpha}\bar{L}^{1-\alpha} - \underline{c}N_{A,PR,\theta_R}}{N_L} - \theta_R \tag{34}$$

$$N_{A,PR,\theta_R} = \left(\frac{\alpha A}{\underline{c}}\right)^{\frac{1}{1-\alpha}}\bar{L} \tag{35}$$

The solution is found by making (34) bind.

$$\theta_R^* = \frac{(1-\alpha)\left(\frac{\alpha A}{\underline{c}}\right)^{\frac{\alpha}{1-\alpha}}A\bar{L}}{N_L} - c_L \tag{36}$$

The tax revenue amounts to

$$T_{\theta_c}^* = (1-\alpha)\left(\frac{\alpha A}{\underline{c}}\right)^{\frac{\alpha}{1-\alpha}}A\bar{L} - c_L N_L \tag{37}$$

4 Empirical evidence on taxes and population densities

In the previous section we highlighted the fundamental structural difference between China and Europe in the eighteenth century: China was a single geopolitical entity that was largely peaceful, whereas Europe was a collection of competing states that were constantly at war. In consequence, European governments needed to maximize the power of their armies which necessitated tax revenues to feed them and landowners to lead them. This explains why European states tolerated the existence of landowners who siphoned off tax revenues that would otherwise have gone to the state, whereas China opted not to do so. The existence of landowners in Europe is thus already one piece of evidence that is consistent with our story. But our simple model in fact generates a number of empirically testable predictions.

First, we expect countries with larger tax and rental burdens per capita to have higher land-labour ratios because marginal workers will be taxed out of existence.

Second, we expect average and marginal labour productivity to be higher in countries with higher land-labour ratios (i.e. higher tax and rental burdens).

4.1 Taxes and population in China

Our model predicts that a higher per capita tax burden will drive marginal workers to extinction and raise the land-labour ratio (i.e. reduce population density). We can test this hypothesis both across countries and within countries, where there is significant local variation. Testing within countries offers homogeneity of tax collection regimes, social customs and other factors which are difficult to quantify and which might make a cross-country comparison inaccurate.

Good data exist for 18 Chinese provinces for the mid- to late eighteenth century and in table 1 below we report the results of a regression of provincial agricultural population densities on local land tax burdens. The relationship between population density in 1749 and the per capita taxation burden in 1753 is strongly and significantly negative, with an r-squared of 37 per cent. It might be objected that causation runs in the opposite direction (i.e. low population densities raised income per head and permitted higher tax burdens). There are several counter-arguments to this. First, we have a model that explains why causation runs from taxes to population a model based on Malthus original insight and which has been generally accepted for the last 200 years to apply to the period that we are examining. If we believed that causation ran from population to taxation then we would need a model to explain the local variation in population. Second, we can repeat the regression using population density in 1775. Taxation in 1753 is clearly exogenous to population density in 1775. Moreover, this regression makes more sense if we expect population to take some time to respond to the level of taxation. Sure enough, the elasticity of 1775 population density with respect to 1753 taxation is higher than the elasticity of 1749 population which is what logic tells us to expect. The

r-squared is also higher, at 44 per cent. Of course, empirical evidence can never validate a hypothesis; it can only ever falsify it. Our model is not falsified by the empirical evidence for China.
Table 1 about here.
Notes and sources. All variables are in natural logarithms. Dependent variable is the population per acre in 1775, drawn from Brunt and Fidalgo (2008); independent variable is the tax burden per capita in 1753, drawn from Wang, Land taxation, table 4.1. ** denotes statistical significance at the one per cent level and * denotes statistical significance at the five per cent level.

4.2 Tax burdens in England and China compared.

It is interesting to compare taxes across countries, although this is fraught with considerable difficulty. It is inevitably difficult to find all the relevant data for various countries, particularly since a wide variety of taxes were levied on agriculture across different countries. Moreover, there are subtleties in data interpretation that need to be considered carefully. For example, in England it is unclear exactly who paid the land tax. If it were the landowner then this tax take presumably came out of the landowners rental income and is thus already incorporated into the cost of land, so we should not add the land tax to the rent in order to calculate the total tax burden on agricultural workers. However, in the first instance the tax was actually payable by the occupier of the land (i.e. the tenant) and the rental contract might well stipulate that the tenant pay "all rates and taxes" or "all outgoings", which would include the land tax; this would make the land tax take a net addition to rent take and we should count both of them as extractions from agricultural workers. The same problem arises with respect to the tithe and, in the absence of better information, we assume that the person who paid the tithe also paid the land tax. Clark (2002) suggests that the tenant typically paid the tithe in the eighteenth century, although this had changed to being the landowner by the late nineteenth century, and we follow Clark in this assumption.
Table 2 below shows the itemized annual tax and rent burden on the English agricultural workforce in 1775. This stood at a phenomenal 4487d (over 18). The average annual salary of a farm labourer at this time was around 20 per annum. Since salaries were not taxed, this implies that around one half of the marginal workers produce was extracted in the form of tax.
Table 2 about here.
Notes and sources. Since taxes on English agriculture were levied on the basis of land utilization, we first calculated the tax burden per acre and then multiplied this by the number of acres per adult male agricultural worker (20.17). The sample of 400 farms presented by Young in his Southern, Northern and Eastern tours suggests that the average arable rent in 1775 was around 168d per acre. Clark, Farmland rental values, 286 gives the tithe as being 12.2 per cent of the combined value of rent and tithe, which would make it [12.2/(100-12.2) =] 13.9 per cent of the value of rent. Slack, English Poor Law, 30, gives the total tax take of the poor rate which was also levied on occupiers of land as 1 528 780 in 1776, which we divide by a total acreage of 27 million to get the burden per

acre. Dowell, History, vol. 3, 81-7, gives the total land tax take in 1771 as 1.98 million, which we again divide by a total acreage of 27 million to get the burden per acre.
By contrast, the annual tax burden on a Chinese adult male agricultural worker around 1775 was about 47d; since they were mostly owner-occupiers, there was no rent burden. Chinese output per worker was around ten per cent of the English level (Brunt and Fidalgo, 2011) and the combined tax and rent burden around 1 per cent, so Chinese workers were definitely more lightly taxed both absolutely and relatively.

5 Conclusion

.[TO BE ADDED]

6 Appendix. Additional results on taxation in a Malthusian world.

Here we consider possible alternative tax structures and calculate their effects on equilibrium population and productivity. [UNDER REQUEST]

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