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How Landownership Equality Created a Low Wage Society: Pre-industrial Japan, 1600-1870

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Abstract

Despite its sophistication, Early Modern Japan, 1600-1868, had among the lowest real wage levels ever recorded, half of those in pre-industrial England. This paper resolves this puzzle by considering the more equal landownership distribution in Japan relative to Europe. Due to institutional differences in land transmission, most of the rural population were landless in England but only 16% in Japan circa 1800. Using a Malthusian model, I show landownership equality in Japan paradoxically generated lower wages and GDP per capita. This is due to the concavity in the positive income-fertility curve resulting in greater equality generating greater population pressures. I provide evidence of the mechanism at the cross-country level and at the individual level using Japanese village censuses. If, as many historians believe, high wages in western Europe explain the onset of the Industrial Revolution, then Japan's failure to industrialize first could have been shaped by its unusual pre-industrial equality.

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Recent discussions on why the Industrial Revolution occurred in Europe and not in Asia have focused on the much higher wages and GDP per capita in pre-industrial Europe (Galor and Weil, 2000; Voigtländer and Voth, 2006; De Vries, 2008; Allen, 2009; Broadberry et al., 2015a). Yet there has been little explanation of why in a Malthusian regime, wages in Asian societies such as pre-industrial Japan were so low. Malthus believed higher living standards in Western Europe stemmed from European restrictions on fertility which is currently known as the European marriage pattern (Hajnal, 1965; Voigtländer and Voth, 2013). However, we now know that there were constraints on fertility in East Asia as great as those in Europe (Tomobe, 1991; Lee and Feng, 1999; Chen et al., 2010). More recently, historians have questioned the premise of low Asian wages because they seem too low for these sophisticated societies (Hanley, 1997; Pomeranz, 2009). In fact, these wages were so low that they were insufficient to feed a family of four on a bare-bones basket of goods (Bassino and Ma, 2006; Kumon et al., 2020) which have raised questions on their accuracy. This paper shows evidence that these wages accurately represent the living standards of the landless peasants in the case of Japan. Instead, I show the low wage equilibrium in pre-industrial Japan stemmed in part from a social system that resulted in a much more equal distribution of landownership than in Western Europe.

I first develop a novel Malthusian model, the standard model for pre-industrial societies (Galor and Weil, 2000; Voigtländer and Voth, 2012), that is augmented with landownership inequality. The Malthusian logic is that humans behaved akin to other animals in reproducing as much as possible conditional on available resources. In a perfectly equal society, population will reach an equilibrium where GDP per capita is at subsistence level, defined as where net fertility is zero. However, aggregate fertility patterns change if resources are unequally distributed. This is due to biological limits to fertility resulting in a concavity in the relationship between incomes and fertility. Thus, the marginal income for a high income household results in a lower increase in population density relative to that for a low income household.

During pre-industrial times, inequality was primarily generated via unequal land distributions while wages were very equal due to low human capital. I therefore model a society with two factors, land and labor, where only land is unequally distributed. Although many people worked on their own farms at this time, I assume everybody earns the same (implicit) labor and land rental income regardless of whether they are transacted on the market. In the extreme case where one infinitesimally small household owns all of the land, population reaches equilibrium where wages are at subsistence level and allow for net zero fertility. This contrasts with the case of equilibrium under perfect equality where wages plus land rents (or GDP per capita) are at subsistence level (see figure 1). This novel prediction can explain why

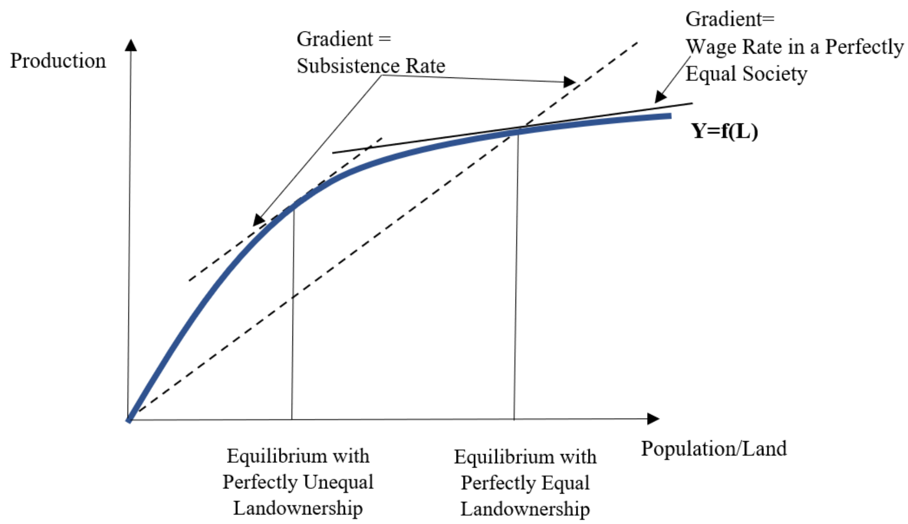


Figure 1: Equilibria under Perfect/Imperfect Inequality in Landownership

(implicit) wages in societies like Japan necessarily reached an equilibrium below subsistence levels. Although living standards are similar for the typical household under both cases, the more unequal society has relatively expensive laborers and more surplus resources beyond subsistence. This matches the intuition for the more general case where greater equality predicts an equilibrium of lower wages and GDP per capita.

Consistent with the model, I present cross-country evidence that shows a positive correlation between inequality and wages or GDP per capita. The evidence from Japan, 1637-1872, shows it had a highly equal distribution of land with a Gini coefficient of 0.57 in addition to 84% of households owning land. Additionally, wages were low and could only sustain 2-3 adults on a barebones diet which made these people the poorest in the pre-industrial world. This contrasts with England and other Western European societies which had high inequality, with most households being landless. Wages were also higher and could sustain 5-6 adult (Clark, 2001). In addition to the positive correlation between landownership inequality and wages, there is further evidence for a positive correlation between income inequality and GDP per capita that is consistent with the pre-industrial literature (Milanovic, 2017).

I then investigate the key micro-level prediction on how equilibrium wage levels relate to fertility. The past literature has found European societies followed the Malthusian logic Madsen et al. (2019) and had a landless class with close to net zero fertility (Clark and Hamilton, 2006; Cummins, 2020) which is consistent with the predictions. However, there has been no evidence for low wage societies under an equilibrium where wages alone did not allow zero net reproduction. I add to this evidence using newly collected demographic data from village censuses across 334 Japanese villages, 1660-1870. First, I show the data fits the assumption of a clear concavity in the positive relationship between fertility and landownership. There is a concern for reverse causality as families planning to have greater fertility may accumulate lands. I address this concern using the instrumental variable of a twenty year lagged landownership and show similar results. The greater fertility was driven by the extensive margin of fertility. Second, I show some evidence for a weaker negative effect of landownership on mortality rates.

Third and most importantly, I show that the land poor, relying on low (implicit) wages, failed to reproduce demographically. The land-rich, earning (implicit) land rents in addition to (implicit) wages, experienced population growth. Due to the equality in land distributions, there were sufficient land-rich households to keep overall population in equilibrium despite low (implicit) wages. Therefore, a low wage equilibrium was sustained over many centuries. This is the first evidence to show a society in this alternative Malthusian equilibrium. This not only explains the puzzle of low absolute wages in Japan but can also potentially explain why pre-industrial Asia in general had low wage societies. A back of the envelope calculation suggests 53% of the wage gap between Japan and Northwest Europe can be explained by differing inequality.

Finally, why was Japan, and East Asia in general, more equal than Western Europe? Kumon (2021) shows inequality differences between East and West were partially driven by institutional differences in adoption that led to differing inequality equilibria. In pre-industrial times, adoption was used as a means of securing male heirship against high child mortality rates. By assuring heirship, wealth could be kept within the male line over many generations. This institution was highly common across Eurasia until the Christian church began preaching against it in the 4th century (Goody, 2000). This resulted in the decline of adoption in Europe and the extinction of 25% of male lines per generation. These failed male lines redistributed their wealth to their relatives, who themselves had their own wealth, using social institutions such as the marriage of daughters or wills. As a consequence, wealth became more concentrated in Europe and this resulted in higher inequality and, via long-run Malthusian forces, greater riches.

This paper contributes to the literature linking inequality to long-run development. Evidence in modern societies suggests greater inequality results in slower growth over the long-run (Persson and Tabellini, 1994; Deininger and Squire, 1998; Barro, 2000; Easterly, 2007; Halter et al., 2014; Berg et al., 2018). The channels through which inequality affects economic development are diverse and include institutions (Brenner, 1976; Sokoloff and Engerman, 2000; Easterly, 2007), political economy (Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Acemoglu et al., 2011), and education (Galor et al., 2009; Cinnirella and Hornung, 2016). However, the effects of inequality may have significantly different effects in pre-industrial societies where human capital played a lesser role (Galor and Moav, 2004). This paper shows that, unlike in modern societies, inequality had a positive effect on equilibrium income levels in pre-industrial societies. Although this did not in itself create sustained growth, this could have enabled the earlier take-off of Western Europe through an earlier transition due to education (Galor and Weil, 2000), European conquest (Diamond, 1997), greater demand for goods (De Vries, 2008), or a greater incentive to substitute labor for capital (Allen, 2009).

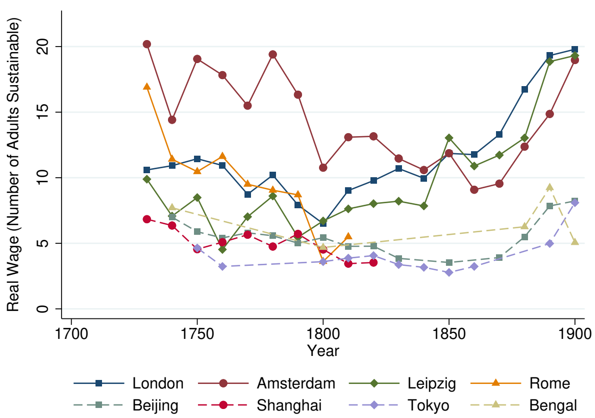
This paper also contributes to a long historical debate on the timing of divergence between Western Europe relative to East Asia which continues to shape the world today. Although Pomeranz (2009) argued the divergence between these regions only began when Western Europe industrialized, a more recent quantitative literature has shown the divergence occurred much earlier (Bassino and Ma, 2006; Allen et al., 2011; Kumon et al., 2020). To explain the early advantage of Western Europe, scholars have investigated multiple factors such as social organization Greif and Tabellini (2017), institutions and technology Sharp et al. (2012); De la Croix et al. (2018), geography Diamond (1997), demography Clark (2008); Voigtländer and Voth (2012), and agricultural endowments Geertz (1968); Vollrath (2011). I show that an additional factor was the institutional and demographic features that prevented European levels of inequality in East Asia, which in turn created highly sophisticated but poor societies.

Stylized Facts of the Pre-industrial World

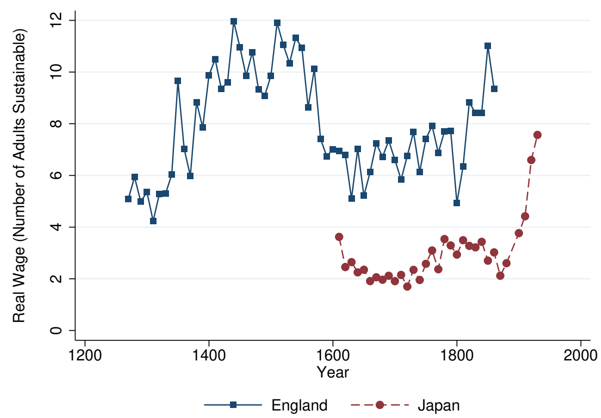
Rich Europe, Poor Asia

A major historic question is whether the sophisticated societies of East Asia were as rich as those in Western Europe. A quantitative literature has attempted to answer this question by measuring incomes, both wages and GDP per capita, in the pre-industrial world. The evidence from these studies have been compiled and plotted in figure 2.

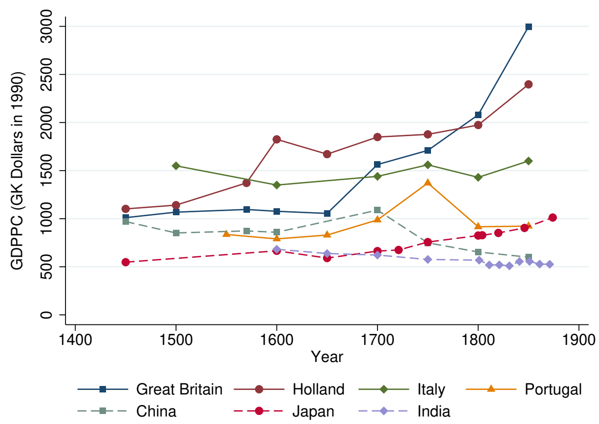
The first evidence are urban unskilled male wages as shown in figure 2a. Unskilled wages are the standard measure of worker incomes due to the pre-industrial world being mainly composed of unskilled and uneducated laborers who earned similar wages. Wages are made internationally comparable by creating "bare-bone" baskets of cheap goods that would allow an adult male to survive in each of these societies (Allen, 2001). The urban evidence shows wage levels were generally higher in Western European societies relative to Asian societies by the 18th century. Importantly, this is not driven by an upward bias due to contractor margins (Stephenson, 2018) as recently pointed out in the literature. I account for this in



(a) Urban Unskilled Male Wage



(b) Rural Unskilled Male Wage



(c) GDP per Capita Estimates

Figure 2: Pre-industrial Incomes

The wages are measured in the number of adult men sustainable on a bare-bones diet per day of work. They are then averaged by decade in order to show the long-run trends. For the case of London wages, I adjust wages downward by 40% to account for the contractors margin as shown by Stephenson (2018).
Sources: Barebones urban unskilled wages are taken from Allen et al. (2011) with the addition of Rome from Rota and Weisdorf (2020). Rural unskilled wages are taken from Clark (2001) and Kumon et al. (2020). GDP per capita data are taken as reported in Broadberry et al. (2015b), Broadberry et al. (2018), Palma and Reis (2019), and Nakabayashi et al. (2020). However the estimates reported in these papers also include those by Malanima (2011), Van Zanden and Van Leeuwen (2012) and Broadberry et al. (2015a).

London where I assume 40% of the wage went to contractors but a substantial wage gap remains.[1] The only exception are the periodically low wages in Germany and Italy. However, these appear to be temporary declines that were driven by higher prices during periods of war such as the Seven Years' War and the Napoleonic Wars. In contrast, East Asian wages were consistently low.

The second piece of evidence is from rural unskilled male wages as shown in figure 2b. These wages are better representative of the rural masses within these predominantly agricultural societies. This can address concerns that differing urban wages can be attributed to differing rural-urban wage gaps. Unfortunately, there are limited wage series but the case of Japan and England shows a clear and persistent divergence since at least the 17th century. Whether we look at rural or urban wages, a clear divergence appears between these regions.

Finally, there is evidence from recent estimates of GDP per capita by country. These data are the best current estimates but requires some caution due to differing levels of accuracy by society and period. Despite this issue, a consistent finding is that Asian societies were generally poorer than their Western European counterparts. This remains true in later periods when the GDP per capita estimates are more accurate. Japan and India are particularly poor with less than half of most European GDP per capita levels.

Overall, these three differing measures of incomes agree in depicting a rich Europe versus a poor Asia. Further, the divergence between these regions long predate the industrial revolution. This suggests an early divergence in incomes that were driven by long-term differences, spanning many centuries, between these regions.

Greater Inequality in Europe

How far did inequality differ across regions in the pre-industrial world? In order to measure this, economic historians have taken two approaches. The first is to collect household level wealth data and measure wealth inequality. The second is to estimate average incomes by social classes, a method known as social tables, and use these to estimate income inequality in society as a whole. The findings from these studies are shown in tables 1 and 2.

The broad finding from wealth inequality estimates is that inequality was much higher in Western Europe than East Asia. Gini coefficients are lower in East Asia where it ranged from 0.4-0.6 than Western Europe where it ranged from 0.7-0.9. The share landless is also much lower in East Asia where most households owned land unlike in Western Europe. However, wealth inequality estimates must be interpreted with some caution. Due to data limitations, estimates cannot be streamlined across societies to the same extent as modern data. Some

[1] This is the upper end of estimates of contractor margins made by (Stephenson, 2018).

Table 1: Wealth Inequality in Pre-industrial Societies

Country	Year	Type	Unit	Gini	Landless %
East Asia					
Philippines	1903	Land	Rural Households		19
China	1930s	Land	Rural Households	0.35–0.43	17–33
Japan*	1647-1872	Land	Rural Households	0.57	16
Western Europe					
England*	1720-1850	Land	Rural Adult Males	0.7-0.9	40-60
France+	1825	Land	Rural Households	0.71	
Germany+*	1800	Real Estate	Rural Households	0.53	
Sweden	1750	Wealth	Rural Households	0.72	50.4
Denmark	1789	Wealth	Rural Households	0.87	59
Finland	1800	Wealth	Rural Adult Males	0.87	71
Northern Spain	1749-59	Land	All Households	0.87	
NW. Italy+*	1700-99	Real Estate	Rural Households	0.77	
NE. Italy+*	1750	Real Estate	Rural Households	0.79	
Central Italy+*	1700-99	Real Estate	Rural Households	0.75	

+ indicates propertyless are excluded. * indicates village-level estimates. The Philippines estimate is the share of farms cultivated by tenants which likely results in an overestimate. Chinese estimates from the 1930s use figures for North China and South China to get a range of Gini coefficient. The proportion landless is from two different estimates for all of China in Buck (1937). English estimates are based on land areas rather than values. French estimates are based on tabulated data from Heywood (1981). Northern Spain's estimates are from Palencia, Northwest Italy estimates are from Piedmont, Northeast Italy estimates are from the Republic of Venice, and Central Italy estimates are from Tuscany. The tables are taken from (Kumon, 2021) where further details are available.

Sources: Sanger (1905), Buck (1937), Soltow (1979), Heywood (1981), Soltow (1981), Brandt and Sands (1990), Kung et al. (2012) , Alfani (2015), Nicolini and Ramos Palencia (2016), Alfani and Ammannati (2017), Bengtsson et al. (2018), Alfani and Di Tullio (2019), Alfani et al. (2022) Kumon (2021)

Table 2: Income Inequality in Pre-industrial Societies

Country	Year	Type of Data	Gini
Western Europe			
Old Castile	1752	Income Census	0.52
France	1788	Social Tables	0.55
England & Wales	1759	Social Tables	0.51
Netherlands	1808	Tax Census of Dwelling Rents	0.56
Kingdom of Naples	1811	Tax Census	0.28
Asia			
India-Mogul	1750	Social Tables	0.39
China	1880	Social Tables	0.24
Java	1880	Social Tables	0.39
Japan	1895	Tax Records	0.40

Source: I use the Gini1 from (Milanovic et al., 2010) where available.

estimates are made at the village level while others at the national level. The type of wealth also differs. Could this be driving the findings?

A careful look at each of these factors suggest otherwise. First, wealth in the form of land is observed in East Asia while other categories of wealth are also included in some European measures. However, when data allows for the decomposition of wealth, lands are the most unequally distributed category of wealth (Nicolini and Ramos Palencia, 2016; Bengtsson et al., 2018). Therefore, if anything, we expect the bias to be downwards in Western Europe. Second, some estimates are at the village level while others are at the national level. For village level estimates, this means between-village inequality is ignored resulting in a downward bias. However, the comparable village level estimates from Japan, England, Italy, and Germany show similar results. Further, the share landless is robust to this concern and also shows greater equality in East Asia.

A final concern is whether this could be driven by the timing of our observations. For wealth inequality, Kumon (2021) shows Japan had highly stable inequality over centuries. Thus, Japan seems to have been in a low inequality equilibrium (see appendix A). In contrast, wealth inequality was increasing in Western Europe and was heading towards a higher level equilibrium. This was not just a phenomena in the centuries leading up to industrialization. Inequality was also high preceding the black death (Alfani, 2015; Alfani et al., 2022). Thus, these societies seem to have fundamentally differed over many centuries.

An alternative measurement of inequality is based on incomes as measured by Milanovic et al. (2010). I compiled the relatively reliable data from the 18th-19th century in table 2.[2] I find income inequality was generally lower in Asian societies, where it was close to 0.40, relative to Western European societies, where it was close to 0.55. The gap between regions is smaller when looking at income inequality but this is due to labor incomes being highly equally distributed in pre-modern times because most laborers were unskilled and earned unskilled wages. Thus, looking at income inequality, which combines wage inequality with wealth inequality, results in a shrinkage in inequality.

Importantly, these two measures of inequality were generally constructed from independent sources but still show similar results. This lends confidence to the idea that inequality outcomes across these regions had diverged. The East had equal landowning peasant societies while the West had evolved into unequal landless laborer societies. Thus, there were two divergences. One divergence in incomes and another divergence in inequality.

A Malthusian Model with Inequality

I now develop a Malthusian model that is consistent with the earlier findings of poorer societies also being more equal societies. There are two factor in this model, land and labor. Labor is equally distributed while lands can be unequally distributed. To keep the model solvable, I take an exogenous distribution of land and focus on conditions under which there can be equilibrium for the particular distribution of land.[3] The use of the Malthusian model is justified by much quantitative evidence of its mechanisms at work in pre-industrial societies (Nicolini, 2007; Kelly and Gráda, 2012; Madsen et al., 2019) which has led to it becoming the staple model for pre-industrial societies (for example, (Galor and Weil, 2000)).[4]

Production, Incomes, and Consumption

Suppose we have a agricultural economy, with the following Cobb-Douglas aggregate production function.

$$Y_t = A_t L_t^{\beta} H_t^{(1-\beta)} \tag{1}$$

[2] I focus on Gini1 measure that assumes the lack of within-class inequality. This is because the Gini2 assumes an arbitrary distribution of within-class inequality based on the difference in incomes with the next highest income rank. This alternative measure makes little difference except for Moghul-India where the much higher Gini2 is driven by there being only 4 social classes that have large income gaps.

[3] This is a common way of incorporating inequality since endogenous inequality is difficult to model (Matsuyama, 2002).

[4] Although an initial finding was little or no Malthusian effect by the 18th century (Nicolini, 2007; Kelly and Gráda, 2012), a recent paper by Madsen et al. (2019) showed this was likely due to omitted variable bias and strong Malthusian forces were in fact active.

Where Y_t is aggregate production, A_t is TFP, L_t is aggregate labor, H_t is aggregate land, and β is the share of labor in production. Each unit of labor compose a household, or in other words, each household has one unit of labor. I fix the quantity of land at $H_t = 1$. There are well functioning land rental markets, as have been found in Japan (Arimoto and Kurosu, 2015), so that labor is evenly distributed across land, with plots of size $\frac{1}{L_t}$. All households are simultaneously farming and renting out land (if they own land), and whether the household is farming it's own land or not is irrelevant. In a Cobb-Douglas type economy, factor prices of one unit of input are determined as follows:

$$w_t(L_t) = \frac{\beta Y_t}{L_t} = \beta A_t L_t^{\beta-1} \tag{2}$$

$$r_t(L_t) = (1-\beta)Y_t = (1-\beta)A_t L_t^{\beta} \tag{3}$$

In this economy, factor prices are determined by the total population and an increased aggregate labor force decreases wages and increases rents.

Income is composed of wages and land incomes. Wages are the same for all individuals. The land income is distributed according to an exogenous distribution of landownership. Let $F(H)$ be the cumulative distribution function of land; that is $F(H)$ is the fraction of households whose landownership are less than or equal to H, where $0 \leq H \leq 1$.

Consumption decisions are effectively ignored in this model, as there is only one good. Each household consumes their whole income, which is composed of wages and land rents minus a taxation (denoted by T) per unit of landownership. The taxed money disappears from the economy, which reflects the low level of welfare provided by governments in pre-industrial times. Thus, income of household i is specified by equation 4.

$$y_{i,t}(L_t, H_{i,t}) = w_t(L_t) + (r_t(L_t) - T_t)H_{i,t} \tag{4}$$

Demography

I take the standard assumption in the Malthusian literature, that birth rates and death rates are determined by the level of consumption for each individual household. I assume a functional form such that

$$b(y_{i,t}) = y_{i,t}^{\varphi_b} \quad where\ \varphi_b \in (0,1) \tag{5}$$

$$d(y_{i,t}) = y_{i,t}^{\varphi_d} \quad where\ \varphi_d \in (-\infty,0) \tag{6}$$

where $b(.)$ denotes birth rate and $d(.)$ denotes death rates. I assume that birth rates are concave and death rates are convex. The Malthusian literature often refers to a subsistence income level, which I define in this context as follows.

Definition 1 *The subsistence income level in this economy is the income (or consumption) level y^* such that $b(y^*) = d(y^*)$. The subsistence income level is normalized to $y^* = 1$.*

The aggregate birth rate and death rate are

$$B(L_t) = L_t \int_0^1 b(y(H, L_t))f(H)dH \tag{7}$$

$$D(L_t) = L_t \int_0^1 d(y(H, L_t))f(H)dH \tag{8}$$

The dynamics of the economy are driven by the following equation.

$$L_{t+1} = L_t + B(L_t) - D(L_t) \tag{9}$$

Given this structure of the economy, we can define equilibrium as follows.

Definition 2 *The economy is at equilibrium when there is a population of size L^* and distribution of land $F(H)$ such that*

$$B(L^*) = D(L^*)$$

I am silent about how a particular land distribution is reached. This is because modelling such dynamics would not only be tricky, but also require strong assumptions on how land is inherited across generations.

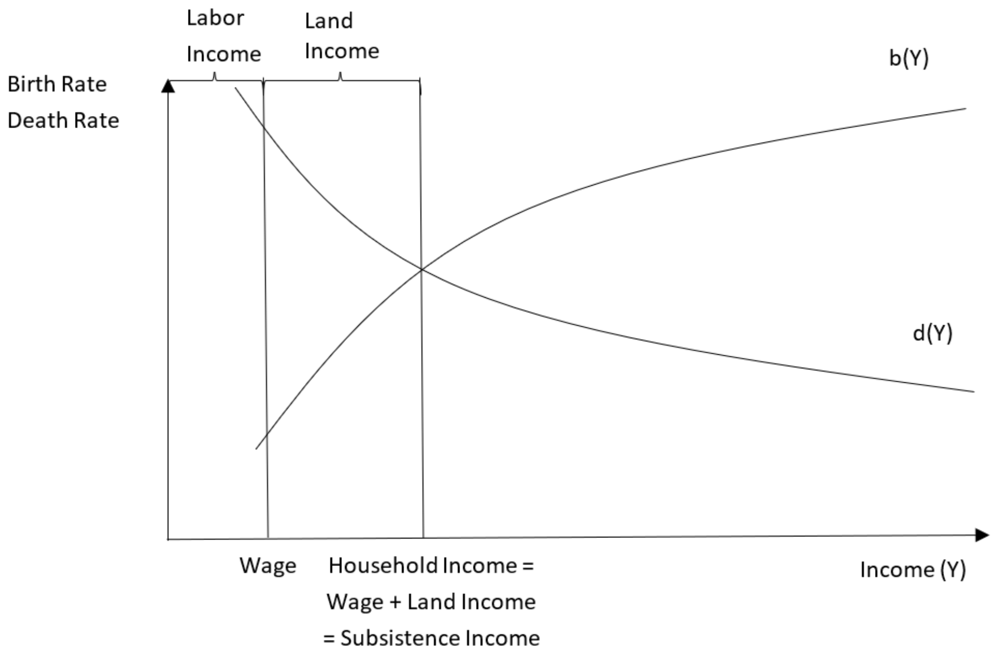
Case 1: The Extremes of Inequality

I first illustrate the model's implications with some examples. In the case of perfect equality, I find that $c_{i,t} = \frac{Y_t}{L_t} - \frac{T_t}{L_t} = 1$ for all i determines the equilibrium, such that $w_t = \beta(1 + \frac{T_t}{L_t})$. This is shown in Figure 3a, and it is clear that wages are necessarily below subsistence level. The wage level is determined by labor's share of production and the level of taxation.

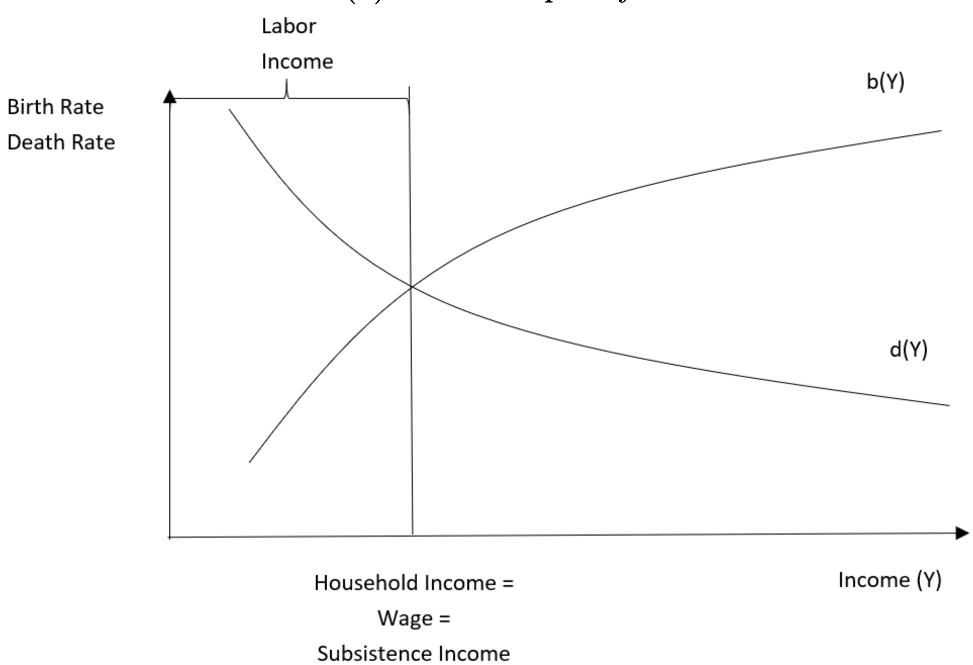
$$\frac{dw_t}{d\beta} = 1 > 0, \quad \frac{dw_t}{dT_t} = \frac{\beta}{L_t} > 0 \tag{10}$$

Both higher taxation and a higher labor's share increase wages. This case provides a lower bound for wages within a economy.

A second extreme case is where an infinitesimally small household, who has no effect on aggregate population, owns all of the land. In this case, the only income received by almost



(a) Perfect Equality



(b) Perfect Inequality

Figure 3: The Extreme cases

all households are wages. In this case, $y_{i,t} = w_t = 1$ determines the equilibrium as shown in Figure 3b. Wages will be much higher and able to sustain a family at zero net reproduction.

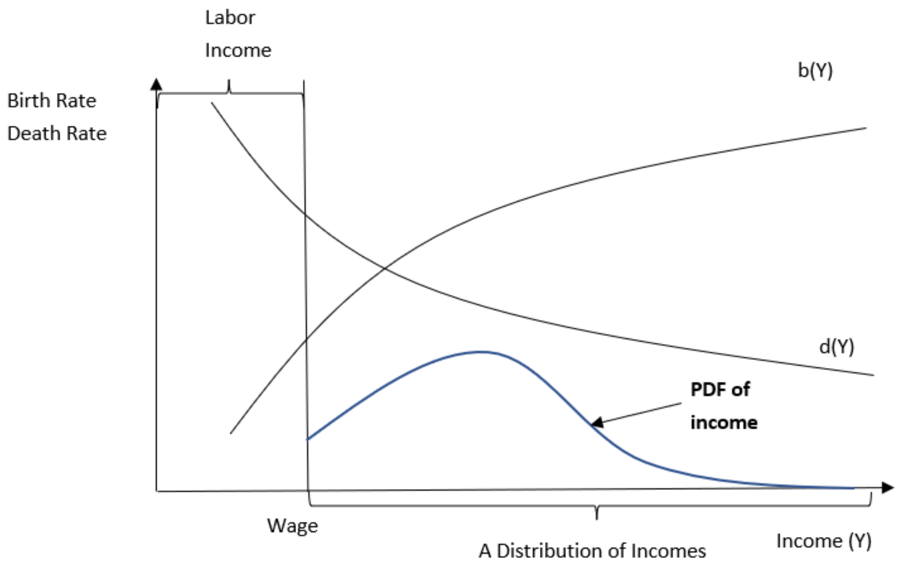


Figure 4: The General case

Case 2: The General Case

In general, there is a distribution of incomes with the minimum income being the wage rate. The wage rate will be less than or equal to one in all cases. Equilibrium is reached where the declining population of smaller landowners balance out the increasing population of larger landowners. The lower end of the income distribution must have negative population growth in equilibrium.

In order to understand how various levels of inequality affect wages, I define an increase in inequality as a transfer of land (and therefore income) from any individual to a richer individual. In this case, I would say there is an increase in inequality compared to the initial distribution of income. More formally:

Definition 3 *Suppose the initial distribution of land is $F_0(H)$, and there are two levels of landownership, H_1 and H_2 such that $H_1 < H_2$. Suppose there is a transfer of land of size $\epsilon > 0$ across individuals such that the individual who had H_1 ends up with $H_1 - \epsilon$ units of land, and the individual who had H_2 ends up with $H_2 + \epsilon$ units of land. I call any distribution resulting from any number of transfers described above as $F_1(H)$. I say $F_1(H)$ has an increased level of inequality compared to $F_0(H)$. If instead the economy moves from $F_1(H)$ to $F_0(H)$, I say there is a decreased level of inequality.*

Given this narrow definition of inequality, an economy with higher inequality will result in a increased wage level, as I prove in Proposition 1.

Proposition 1 *Suppose an economy is at equilibrium with land distribution $F_0(H)$. If there* *is an increase in inequality, the economy will have a decrease in population, and an increase in wages.*

Proof. See Appendix B □

One additional feature of the model is that the distribution of income among the rich is less important than its distribution among the poor, due to the decreasing marginal effect of income on population ($\frac{d^2(b(y)-d(y))}{dy^2} < 0$) and hence its effect on wages. Thus, a society facing changes in inequality due to transfers among the nobility, all else being equal, will see almost no change in wages.

Although this model was focused on landownership inequality, the intuition will also hold for income inequality. Greater income inequality will also result in lower equilibrium wages.

Summary

The key assumptions were as follows. **A1.** Birth rates are concave and increase with income. **A2.** Death rates are convex and decrease with income. **A3.** Wages and population have a negative relationship. Given this, there were 2 key predictions. **P1.** In equilibrium, equal societies have landless households with decreasing population, as wage earnings alone are insufficient to keep birth rates at replacement levels. **P2.** Increased inequality will lead to higher wages in equilibrium. In contrast, the land-rich have increasing population.

The core evidence in this paper comes from testing **A1**, **A2** and **P1** in the case of Japan using micro-data. This has already been tested for some Western societies (Clark and Hamilton, 2006; Cummins, 2020) but not in the case of East Asia. Assumption **A3.** is not directly tested in this paper as other papers have shown the negative relationship between wages and population in the case of the population shock due to the black death (Clark, 2007). The data for testing assumption **P2.** is much more limited, due to the lack of cross-country data for inequality. However, I will show the existing evidence is consistent with the theory.

Micro-level Evidence

Data

I use population registers (*Shumon Ninbetsu Aratame Cho*) from Japan, 1660-1868. The registers were collected by the lord of each domain in an attempt to weed out Christians who were banned by the Tokugawa shogunate. To achieve their ends, the lords forced every person in each village to annually declare their religion in the survey. Despite Christianity being an extreme minority in Japan by the 18th century, the surveys continued as it took on new administrative functions. Some copies of the registers held by the village heads survived in village storehouses, and these were later collected by historians. The data is extremely rich and include the name, age, and the relationship to the household head for all individuals within the village. Additionally, the registers also record the reasons for individuals who entered or disappeared from these registers.

At the household level, the registers also recorded the landownership and less consistently the size of housing. Despite Japan being under a "feudal" system at this time where the law stated that lords "owned" land, peasants had long-standing rights to use, buy, sell, rent, and inherit lands giving them de-facto landownership rights. Thus, peasants can be considered to have been landowners from the economic perspective (for more details see appendix C). The strongest evidence for this can be seen by the large volume of land sales contracts from this period across all of Japan. Despite the land tax, peasants gained significant land rental incomes that could increase their incomes by 50% if they owned all of the lands they cultivated (Kumon et al., 2020).

One limitation of this data is the absence of this elite class. Within this system, the lords functioned similarly to the state today where they would tax the lands. They used this income to pay the samurai. They could be conceived as the equivalent of the landed aristocracy of England. However, the samurai class were surprisingly poor and recent estimates suggest they were only 20% richer than the average peasant unlike in England where they were 9 times richer (Saito, 2015). Therefore, their absence will not affect the general implications of my findings.

I have collected a sample of village population registers from 338 villages as shown in figure 5. The data is from the main island of Honshū in Japan which had 82% of the population in 1750. Although many areas have no observations, much of Japan is composed of uninhabitable mountains where there were few settlements as can be seen on the map. There is better coverage of the central and eastern areas of the island where most of the plains with high population density were located.

There are two types of data. The first is the linked panel dataset of individuals and households from 4 villages amounting to 57,444 individual-year observations from the DANJURO database.[5] These villages are labelled in figure 5. I rely on this richer data source for a robust IV specification. The second are data from un-linked and mostly single year observations of 334 villages which were collected from local histories (see appendix F).[6] This

[5] This dataset was created by Hiroshi Kawaguchi of Tezukayama University. Details are available at http://kawaguchi.tezukayama-u.ac.jp

[6] I have dropped all villages that are urban settlements or coastal settlements where lands are not an important form of asset. I have also dropped villages in which the unit of measurement for landownership

Figure 5: Map of Japan with Village Locations

The 4 villages with panel data are labelled. Shaded regions indicate higher elevations. The map is made using data from Natural Earth.

data amounts to 136,553 observations of individuals. Although this is cross-sectional data, it allows me to have geographical breadth in the analysis. Further, the panel data regressions show that OLS regressions will have very similar results.

I focus on studying the fertility and mortality patterns of the core members of the household. This is because other members of the household were often temporary and may have received a lower priority within the household. I therefore drop all observations of servants and non-core family members within these stem households, such as cousins or younger siblings of the household head, who would usually leave the household.

There are a number of data issues that must be addressed. First, there is measurement error in landownership because only within-village lands are included in the landownership variable. Therefore, lands owned outside the village are missed. However, lands owned

was not in *koku*, the most regular unit.

outside the village were not legally protected (Nakabayashi, 2013) and composed a small share of landownership. Consistent with this, a sub-sample of village registers indicate external landownership was worth perhaps 15% of village lands (Kumon, 2021). The external landownership was positively correlated with within-village landownership which would lead to a slight upward bias in the coefficients. However, it will not affect the sign of the coefficients which is the primary factor of interest.

Second, there is further measurement error in landownership due to land values being based on total yields in cadastral surveys from the 17th century. These surveys never got updated to account for increased plot sizes or increased productivity. A companion paper conducts a detailed test of the accuracy of outdated yields as a proxy for the value of landownership (Kumon, 2021). Using data from the 19th century on both land rent (which is the value of landownership) and outdated yields for a sample of plots, it finds that the outdated yields are highly correlated with land rents. The coefficient of variation of land rents relative to outdated yields is 0.3. This shows measurement error exists but outdated yields are a valid proxy of landownership. This is not surprising as land rents are highly correlated with yields. As attenuation bias may remain a concern, I further use the area of housing, a second type of asset, as an instrument for landownership in a robustness exercise.

Third, births were recorded only if the infant was alive during the registration. Hence, still births or infant deaths preceding the creation of a register are unrecorded.[7] Therefore, the number of births within the data can be interpreted as the number of infants who survived to the first registration.

Fourth, the reasons for migrations and deaths are not always known. This was because village heads often recorded migration and deaths by sticking notes onto the registers that could later become unstuck and lost. For these reasons, I cannot measure all deaths. However, I construct an alternative measure taking all unknown disappearance and deaths as a robustness exercise when considering mortality.

The summary statistics in table 3 are consistent with my hypothesis. They show that household birth rates (total births per 1000 households per year) are positively correlated with landownership.[8] This appears to be driven by a better chances of marriage by the rich because the number of reproductive couples in a household (married women below age 45) is positively correlated with landownership.

The statistics on deaths and out-migration are more problematic. As described earlier,

[7]The extent of missed births are estimated to have been 18-23% of females and 15-20% of males, due to death in infancy (Bideau and Brignoli, 1997).

[8]Here, births capture all entries into the village described as birth and all unaccounted entries into the village below the age of 4.

Table 3: Summary Statistics: 4 Villages

Variable	Nakatō 1843-1864	Hanakuma 1789-1869	Ishifushi 1752-1812	Tōnosu 1790-1859
Village Level				
Population	476	225	126	240
Household Size	5.3	3.5	4.6	4.0
Avg. Landownership (*koku*)	2.6	3.9	3.8	3.6
Landownership Inequality (Gini)	0.51	0.45	0.39	0.47
Household Level				
No. Births per 1000				
by landholding bin				
0-2.5	47	74	71	65
2.5-5	56	101	79	85
5-7.5	74	99	114	135
5.7+	115	110	116	146
All	53	90	85	88
No. Reproductive				
Couples per 1000				
by landholding bin				
0-2.5	669	350	725	495
2.5-5	727	498	819	623
5-7.5	683	548	881	1002
5.7+	787	609	1076	1026
All	685	460	821	646
Individual Level				
Age	30.97	31.34	36.39	33.51
Female=1	0.48	0.50	0.46	0.45
Out-migration per 1000	28	15	14	7
In-migration per 1000	32	16	12	7
No. Deaths per 1000				
by landholding bin				
0-2.5	9	27	20	16
2.5-5	12	25	18	19
5-7.5	14	25	8	16
5.7+	7	26	12	14
All	10	24	16	16

some exits from the village remained unaccounted in the census.[9] Death rates as low as 10 per 1000 seen within some categories which are far too low.[10] However, one village, *Hanakuma* village, has realistic death rates which I can additionally study in isolation.

Specification and Results

I now test the key assumptions and predictions of the model. First, landownership must have a positive/negative effect on fertility/mortality. Second, there is a concavity in the relationship between incomes and fertility. Third, the landless peasant households must have living standards below subsistence. This would be indicated by death rates that are higher than birth rates.

I test these predictions using the following specification.

$$Y_{h,v,t} = \beta_0 + \beta_1 f(Landownership_{h,v,t}) + \beta_2 X_{h,v,t} + \theta_{v,t} + \epsilon_{h,v,t} \tag{11}$$

Here, Y denotes the demographic variable of interest, v denotes village, h denotes household, t denotes time, and X is a set of control variables. The village time fixed effect ensures I am only comparing households or individuals within the same village-year. I use deaths as the dependent variable measuring mortality. However, as some deaths are not recorded, I also use total exits from the village (inclusive of deaths) as an alternative measure. As measures of fertility, I use births and the number of children aged less than 15. I expect β_1 to be positive for fertility measures and negative for mortality measures.

I use household level data when estimating the effects of landownership on fertility and I do not include control variables. The lack of control variables is to avoid over-controlling the regression.[11] When estimating the effects of landownership on mortality, I use individual level data. This allows me to control for age and sex which were key predictors of death.

I do not include individual or household fixed effects because much of the variance in landownership is between rather than within households/individuals, as is confirmed by variance decomposition.[12] A simple OLS regression of landownership and its lag gives a coefficient of 0.996 with standard errors of 0.001, also implying there is very slow change in

[9] I coded all instances in which a death was recorded as a death. All other instances of disappearance are considered as out-migrations.

[10] Within 3 surveys between 1891-1913, the life expectancy at age one were consistently estimated as an additional 49-52 years, or 19-20 per thousand. Given medical advances between pre-industrial times and 1891, the actual number must have been much higher.

[11] For instance, the age of the wife could be a potential control. However, women could be marrying at younger ages into rich households so including this control will bias the effect of landownership downwards.

[12] I find that when I am looking at individuals, the standard error between is 3.7 while within is 1.5. For households, the standard error between is 3.1 while within is 1.5.

Table 4: Fertility and Landownership

	Number of Births		Number of Children w. Age $\leq$ 15		
	(1)	(2)	(3)	(4)	(5)
	OLS	IV	OLS	IV	OLS Other Villages
Landownership	7.828***	11.614***	71.758***	98.490***	41.454***
	(2.081)	(2.926)	(18.548)	(33.700)	(4.527)
$Landownership^2$	-0.150	-0.413**	-1.606**	-3.456*	-0.072***
	(0.106)	(0.189)	(0.761)	(2.018)	(0.010)
Village-Year FE	Yes	Yes	Yes	Yes	Yes
N	8655	8655	8655	8655	16391
Adj-R^2	0.013	0.012	0.069	0.065	0.112
p-val joint sig.	0.000	0.000	0.000	0.004	0.000
Mean Dep. Var.	87.926	87.926	1114.269	1114.269	1356.446

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable are multiplied by 1000 for presentation purposes The IV is lagged landownership and its square.

landownership over time. In such a case, a big concern is that households with time variation in landownership may be a group that is behaving differently, and could lack generality. Therefore, I use a village-time fixed effects to compare differences in demographic outcome within each village-year while using a individual/household fixed effect in a robustness exercise.

The relationship of interest is a correlation between incomes and fertility/mortality. However, one concern is reverse causality whereby households that are about to have children may accumulate land in preparation.[13] If true, I could be partially measuring the reshuffling of land across households during the family lifecycle. I address this by using household landownership lagged by 15 years as an instrumental variable. Due to landownership being a slow moving variable, it is highly correlated with current landownership. However, if it predates decisions to accumulate or sell lands in line with family preferences, it will be a valid instrument. As a 15 year lag is arbitrary, I also conduct robustness tests with other lags.

Fertility

Table 4 shows the effect of landownership on fertility. I find a concave positive effect of landownership on fertility regardless of whether I use an OLS or IV specification. When using my IV, I find a large positive coefficient that each unit of land would increase fertility

[13] Alternatively, households that have had children may sell land.

Table 5: The Intensive and Extensive Margins of Fertility

	Births per Married Women w. Age ≤ 15		Number of Reproductive Couples		
	(1)	(2)	(3)	(4)	(5)
	OLS	IV	OLS	IV	OLS 334 Villages
Landownership	0.858	0.528	51.028***	57.019***	16.214***
	(1.138)	(1.328)	(9.516)	(14.531)	(1.302)
Landownership^2			-1.240***	-1.493*	-0.033***
			(0.431)	(0.794)	(0.004)
Age Controls	Yes	Yes	No	No	No
Village-Year FE	Yes	Yes	Yes	Yes	Yes
N	5283	5283	8655	8655	16391
Adj-R^2	0.027	0.027	0.112	0.111	0.127
p-val joint sig.			0.000	0.000	0.000
Mean Dep. Var.	115.525	115.525	591.797	591.797	797.464

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable is whether a married woman below age 45 had a birth in that year and the number of married women below age 45 within each household-year. Both dependent variables are multiplied by 1000 for presentation purposes and can be interpreted as per 1000 HHs. The IV is lagged landownership and its square. The age control consists of five-year age bracket dummies.

by 11 per 1000 HHs against a sample average of 88 per 1000 HHs with slowly diminishing returns. Therefore, landownership had a very large effect on fertility. I find a similar effect when I alternatively use the number of children below age 15 as the dependent variable. As the average of this variable is 1114 children per 1000 HHs, I find the positive effect of landownership is slightly smaller but similar in magnitude. In both cases, the OLS coefficient is slightly smaller than the IV coefficient and suggests reverse causality is not a major concern. This suggests the use of the OLS specification on a larger sample of villages without panel data should also be reliable. These results in column (5) also show a positive effect and shows the panel results have a wider validity across Japan at the time. Finally, the squared term is always negative showing decreasing returns of landownership on fertility.

How were richer households having more children? This could be driven by either the intensive margin of greater fertility during marriage or the extensive margin of having longer periods of reproduction. I can measure the intensive margin by estimating a similar regression as specification 11 but limiting the sample to married women below age 45 and including 5-year age bracket dummy controls. I can measure the extensive margin by changing the dependent variable to the number of reproductive couples defined as married couples with the wife having an age less than 45. In the case of the intensive margin, I now use a linear specification as concavity should not exist for fertility once we control for age.

The results in table 5 show the differences in fertility were driven by the extensive margin. I find the lack of fertility differences in the intensive margin. The standard errors are small as the dependent variables are multiplied by 1,000 for purposes of presentation. This means we can be 95% sure that any effect is unlikely to increase births by more than 0.003 births per landownership unit. Given average landownership was less than 4 units, the effect is tiny. This is not surprising because literature from Western Europe suggests the lack of family size targeting in this era Clark et al. (2020). On the other hand, there is a strong positive relationship when considering the extensive margin. The coefficients compare similarly to the effects of landownership on births suggesting the extensive margin could explain much of the positive gradient. In appendix A1, I also show the that both men and women in richer households may have married slightly earlier although the coefficients suggest the rich married less than a year earlier. Thus, much of the effect is likely due to higher marriage rates.[14]

Mortality

Table 6 shows the effects of landownership on mortality. As explained earlier, specification (1)-(2) only uses data from one village with reliable mortality statistics. I consistently find a negative effect of landownership on mortality. However, the statistical significance varies with the IV specification showing the lack of significance. However, the model only relies on a non-positive relationship between mortality and landownership and these results are generally consistent with this assumption.

To improve on the generality of these results, I also estimate the relationship between deaths plus potential deaths (the unexplained disappearance of individuals from villages) in other villages. I find a similar result which is reassuring. Further, the assumption in itself is standard as one would expect greater incomes to translate to lower mortality rates. However, the positive square term suggests decreasing returns to income as medical technologies were limited during pre-industrial times.

Robustness

There are a number of concerns with the specification which I address in detail in appendix E. First, the choice of the lag in my IV of lagged landownership is arbitrary. To

[14] The data cannot be effectively used to measure differences in marriage rates. The rich may have higher marriage rate within the core couples within the stem family. However, they are also more likely to have more children who stay unmarried until they leave the household for marriage. There is no good way of teasing out the core members of the stem family, especially within the 334 village dataset.

Table 6: Mortality and Landownership

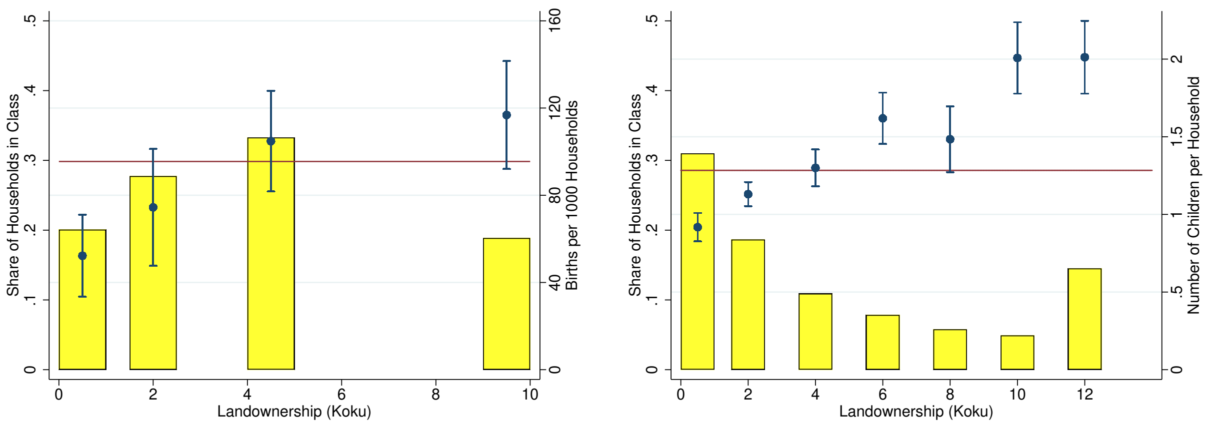
	Deaths		Deaths + Potential Deaths	
	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Landownership	-1.708*	-1.301	-2.159***	-0.576
	(0.870)	(1.151)	(0.644)	(0.981)
$Landownership^2$	0.121**	0.083	0.149***	0.061
	(0.054)	(0.074)	(0.028)	(0.065)
Age-Sex Controls	Yes	Yes	Yes	Yes
Village-Year FE	Yes	Yes	Yes	Yes
N	5869	5869	14749	14749
Adj-R^2	0.006	0.006	0.021	0.020
p-val joint sig.	0.049	0.255	0.001	0.540
Mean Dep. Var.	26.204	26.204	24.358	24.358

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable is the death of an individual multiplied by 1000 for presentational purposes. Potential deaths adds all cases where individuals disappear from a village for unknown reasons. The IV is lagged landownership and its square. The age control consists of five-year age bracket dummies. Specification (1) - (2) uses only data from Hanakuma village which had reliable mortality statitics. Specification (3)-(4) uses all villages with panel data.

address this, I can change the length of lag in my IV up to 30 year with the idea that a longer lag will better satisfy the exclusion restrictions. The results do not change, and are not necessarily more desirable due to potential selection bias of households that remain in the sample. Second, the level of fixed effects could be changed to be at the household level. This would absorb fixed differences at the household level, such as preferences of the household. I address this by conducting the regression with individual/household FE and find similar results. Third, there is concern for measurement error in household landownership. To address this, I additionally instrument household landownership with the area of housing in which they reside. I find a similar result with this specification.

Landownership and Population Growth

The finding so far are not surprising in itself as similar pattern have been found in other societies Clark and Hamilton (2006); Clark (2008); Cummins (2020). However, a unique feature of Japan relative to other societies studied in the literature was the equal distribution of landownership. This resulted in an equilibrium where the landless laborers had significantly negative population growth. To show this, I estimate specification 11 using fertility measures as the dependent variable and landownership bins as the explanatory variable of interest. I use four bins for the panel data analysis, due to lower sample sizes,



(a) Panel Data Villages

(b) 334 Villages

Figure 6: Population Growth and Landownership

The bars plot the share of households in each bin (left axis). The point estimates and 95% Confidence Interval are plotted for births per 1000 households (right axis). The 6+ landownership bin on the left panel is plotted at the average landownership for this class.

and seven bins for the analysis of the other 334 villages.[15] Although these categories are arbitrary, changing them does not alter the results.

The fertility measures are the number of births per 1000 HHs when I use the panel data for the four villages. I would ideally compare this fertility rate to the mortality rate within each village, but the data for deaths are not very reliable. To overcome this issues, I assume mortality rate does not change with incomes. I then use the average death rate of 46 per 1000 individuals from life tables in 1891-1913 as the estimate for mortality rates. Given the average household had 4.1 members, birth rates would have needed to be in excess of 89 for these households to have positive reproduction.

The fertility measure for the non-panel data villages are the number of children below age 15 in the household. In this case, I compare this fertility measure to the average number of children in each household in the post-1720 period. This is because population was static during this period so that this average should be comparable to the number of children required to keep population stable.[16]

I graphically present the results in Figure 6, where I plot the predicted fertility rates of all households for the panel data using the IV specification (figure 6a) and the non-panel data using an OLS specification (figure 6b). The horizontal line represents the threshold for

[15]The four bins are 0-1 *koku*, 1-3 *koku*, 3-6 *koku* and 6+ *koku*. The last bin is plotted at the average landownership for this bin. They fit the historical perception of household classes. The class of 3-6 *koku* correspond to those households who mostly cultivated their own lands. Those above this class would commonly rent out lands and those below would rent lands.

[16]The average births is close to the number I expect based on calculations from life tables in the 1890s.

households to have stable population. I also show the share of households in each landownership bin using a bar chart.

In both sets of data, I can confirm the earlier findings of a positive and concave increases in fertility with incomes. More importantly, I find the households that were close to being landless clearly suffered from a statistically significant negative population growth. As the landless only earned low (implicit) wages, they were clearly below the subsistence income in early modern Japan. This matches the empirical finding from wage studies that show wages could have only sustained 2-3.5 people on a barebones diet and such landless laborers would have failed to sustain a family of four Bassino and Ma (2006); Kumon et al. (2020). In contrast, the land-rich had positive population growth.

Households needed around 4 *koku* of land to sustain themselves. This is close to the average landownership within these villages. At this level of landownership, land incomes would have sustained an additional 1.7 people at around 1800 (Kumon et al., 2020). In addition to the wage income that could feed 3.4 people, the land income would have bought total incomes to levels that could feed 5.1 people (or a 50% increase) on a bare-bones diet. The absolute value of these incomes are compatible with a households' capability to raise children and is consistent with my empirical findings. Thus, land incomes proved decisive for whether a household could reproduce.

Overall population was in equilibrium due to a high level of equality. Around 20-30% of households were land-poor but a similar share of land-rich households counteracted any population decrease being experienced by the land-poor class. Had most of the population been landless, much like in England, there would have been major depopulation. In the long-run, this would increase the marginal productivity of land and hence wages. A new equilibrium would be reached with a lower population and higher wages for the landless. Low wages were only sustained due to Japan having an equal economy.

These findings contrasts with England c. 1600 where even the laboring class had 2.2 surviving children per generation compared to the replacement level of 2.07 (Clark and Hamilton, 2006).[17] The model predicted that a highly unequal society would have landless laborers reproducing just below replacement levels so fertility appears too high. However, the model is based on a society in equilibrium but gradual technological growth meant population was still growing. In such a case, landless laborers having replacement level fertility is consistent with the model prediction.

How far does this mechanisms explain of the gap in wages between England and Japan? I conduct a back of the envelope estimate by comparing subsistence incomes across Japan and England as illustrated in figure 7. In 1800, English rural wages could subsist 6.6 people

[17]The replacement level is taken from (Clark, 2008) 115

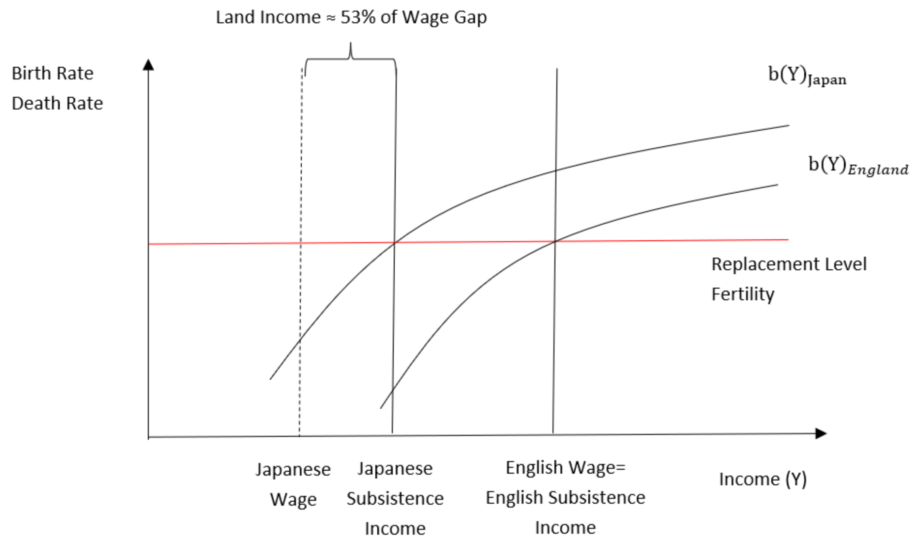


Figure 7: Measuring the Gap in Subsistence Incomes: England and Japan

on a bare-bones diet (Clark, 2001).[18] As calculated earlier, the subsistence income in Japan would have fed 5.1 people relative to the wage which fed 3.4 people. Therefore, at least 53% of the wage gap between England and Japan can be explained by differences in inequality. Other mechanisms were also clearly at play, but a large portion of the gap can be explained by the differing degrees of inequality across these societies.

Discussion

Finally, I discuss how the micro-level findings fit in to the limited cross-country level evidence that equality creates low wage societies. To do this, I estimate the effect of income inequality on GDP per capita and wages in pre-industrial societies. I use the income inequality variable as it is the most comparable and widely available variable across countries. Also, the intuition of the model equally holds when I use income inequality as my measure of inequality. Due to very small sample sizes, I can only show evidence for correlations that are consistent with the model.

The results are presented in table 7. Column (1) uses data on all countries where available and column (2) focuses on societies post-1750 preceding industrialization. The latter should have better quality data for GDP per capita and additionally better capture societies in equilibrium unlike the period following the black death. The positive effect is strong regardless of the dependent variable or sample restrictions which is consistent with the earlier literature (Milanovic, 2017).

[18] I use the bare-bones basket calculated in Kumon et al. (2020). This rural wage was slightly higher than subsistence incomes in England at the time, as the laboring class still achieved positive population growth.

Table 7: Inequality and Incomes

	GDP Per Capita (1)	(2) Post 1750	Unskilled Wage (3)
Income Inequality (Gini)	0.081***	0.079***	0.233**
	(0.024)	(0.027)	(0.075)
N	28	22	9
Adj-R^2	0.284	0.259	0.641

Robust standard errors and are in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Source: incomes and GDP per capita from Milanovic et al. (2010). Wages are from the sources given in figure 2.

One concern behind the proposed mechanism is reverse causality, whereby poverty leads to equality. One concept that underlies this concern is the inequality possibility frontier (Milanovic et al., 2010). This states that poor societies with GDP per capita close to subsistence must be relatively equal. Otherwise, there will be social collapse as people will not have enough to survive. This is an accounting relationship without a proposed direction of causation.

If there is reverse causality, we would expect societies that are getting poorer to also become more equal over time. However, the empirical evidence clearly shows no negative correlation between incomes and inequality over time. In fact, incomes decreased while inequality increased in European societies in the centuries following the black death (Alfani, 2015; Alfani and Ammannati, 2017; Alfani and Ryckbosch, 2016).

From a theoretical perspective, there is little reason to believe a functioning market will decrease inequality as society gets poorer. If anything, modern studies on developing societies near subsistence show mechanisms that will generate greater inequality (Zimmerman and Carter, 2003; Carter and Lybbert, 2012). However, there could be a political mechanism whereby poverty generates equality, especially among democracies via the median voter (Milanovic, 2000; Lupu and Pontusson, 2011). However, pre-industrial societies were not democratic and there is no evidence for the emergence of political institutions redistributing lands in East Asia in reaction to poverty.

Why would inequality differences emerge if not due to reverse causality? One explanation is based on the differences in wealth inheritance across these regions (Kumon, 2021). Western European male lines went extinct 25% of the time because they lacked heirs due to high child mortality rates at the time. As a consequence, their wealth was passed on to other male lines, via social institutions such as wills or the marriage of heiresses, leading to wealth concentration. This increased inequality as the fortunate few men marrying heiresses became rich as they inherited wealth from both their father and fathers-in-law.

In contrast, this did not happen in Japan or East Asia due to the institution of adoption. Households with wealth consistently adopted male heirs so that each household had one male heir. Thus, each household only inherited wealth from their (adopted) parents. Kumon (2021) shows that households that were not land poor had close to zero percent chance of facing male line extinction. Thus, wealth was not concentrated due to household extinctions. Then why was adoption practiced in the East but not the West? Historically, the institution of adoption was practiced in both East Asia and Western Europe until the Christian church began preaching against it in the 4th century. This may have been motivated by the greed of the church, who realized they could profit from male line extinction upon which some could be persuaded to will their wealth to the church (Goody, 2000). This resulted in the decline of adoption in Europe and greater wealth concentration. Overall, the emerging new evidence suggests inequality differences emerged due to differences in institutions rather than an endogenous co-evolution of inequality and incomes.

Conclusion

This paper has shown that early modern Japan had a peculiar Malthusian equilibrium where wages seem insufficient for raising a family. True to this wage level, the population of the landless poor were decreasing. Population was propped up by a sufficient number of land-rich households whose population growth kept total population in equilibrium. Such an equilibrium was only possible due to the highly equal distribution of land in Japan unlike economies in Europe and other continents. Over the long-run, this equality led Japan to develop on the path of a labor abundant economy with low wages, low GDP per capita, and high population as its key features.

A consequence of this equilibrium was poverty. GDP per capita was low and there was little surplus in the economy. Moreover, the landless laborers of Japan, with nothing but their wages to rely on, became perhaps the poorest people in history. However, the landless households were only 16% of the population. Wages were a poor measure of living standards for the remaining 84% of the population who additionally earned land rental incomes. This brought households to income levels at which demographic reproduction was possible. Interestingly, the economy of poverty did not preclude Japan from developing economically. Hayami (2003) shows that less cows and horses were used in agriculture, as they were substituted with manpower. Technologies were developing on a labor intensive path. Japan eventually industrialized from the 1890 from this low wage base.

The findings of these papers may also apply to East Asian societies such as China. Pre-industrial East Asian societies had lower wage levels than Western European societies. They were also relatively equal with landowning peasants forming the majority of their populations. This was partially driven by institutional differences in adoption (Kumon, 2021), which insured against failed biological reproduction and allowed East Asian households to consistently transmit wealth down the male line. In tern, differences in adoption institutions had roots in church preaching in the 5th century. Therefore, the church may have played a key role in creating an usually rich and unequal region by the eve of the Industrial Revolution.

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Appendices

A Long-run Trends in Wealth Inequality

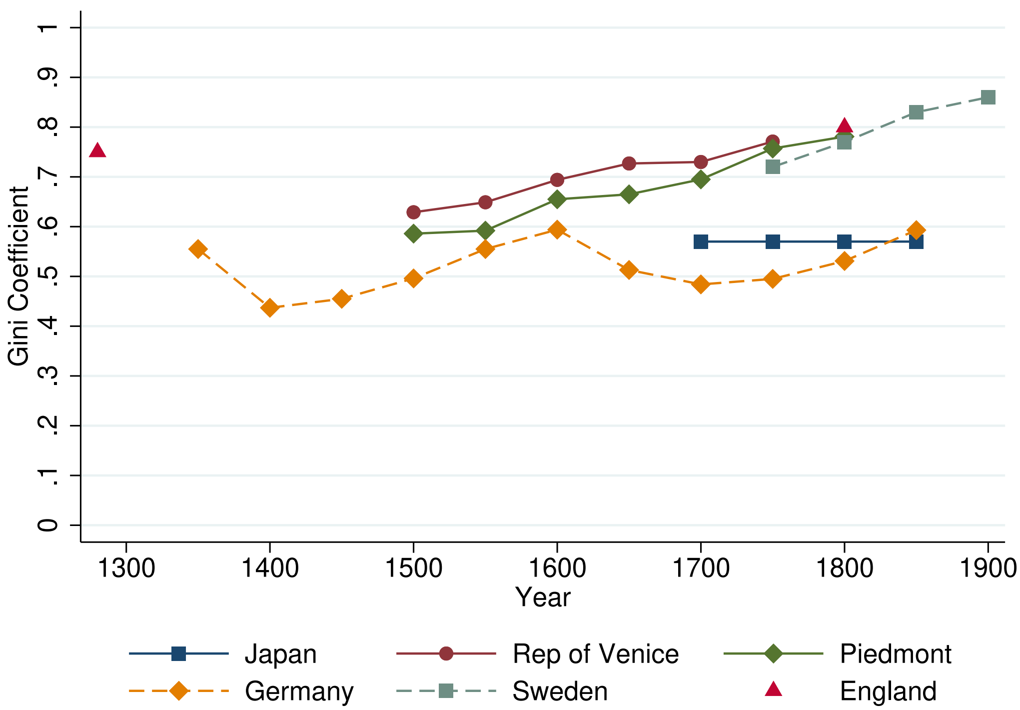

Figure A1: Wealth Inequality over Time

Source: Reproduced from (Kumon, 2021)

Figure A1 shows trends in wealth inequality across societies. With the exception of Sweden, the estimates are at the village level making them largely comparable. There is a clear trend for wealth inequality to increase in Western European societies whereas wealth inequality was stable in Japan. This suggests differing inequality equilibria across these societies. The only exception is Germany but (Alfani et al., 2022) shows this is due to large wars in Germany that temporary reduced inequality. Otherwise, the trend there is also of increasing inequality.

B Proof for Proposition 1

Proof. If I denote the initial equilibrium situation with subscript zero, it is clear that

$$B(L_0) = D(L_0)$$

Suppose a transfer of income ϵ occurred between the poorer individual denoted by subscript p and richer individual denoted by subscript r. Due to the concavity of the function $b(c_{i,t})$, it is clear that the increase in population resulting from increased births by the rich will be smaller than the decrease in population resulting from the decreased birth rate by the poor. The first term below is the change in birth rate for the richer household, and the second term is the change in birth rate for the poor household, the whole term is negative.

$$[b(w_0+(r_0-T_0)(H_r+\epsilon))-b(w_0+(r_0-T_0)H_r)]+[b(w_0+(r_0-T_0)(H_p-\epsilon))-b(w_0+(r_0-T_0)H_p)] < 0$$

Due to the convexity of the death rate function, the overall death rate will also be higher.

$$[d(w_0+(r_0-T_0)(H_r+\epsilon))-d(w_0+(r_0-T_0)H_r)]+[d(w_0+(r_0-T_0)(H_p-\epsilon))-d(w_0+(r_0-T_0)H_p)] > 0$$

As I can say the same for all households that faced transfers, the overall effect is a decrease in population. Due to the decreasing return to land, the lower population causes an increase in wages in the next period. □

C Landownership in Japan: An Institutional Background

Tokugawa Japan (1600-1868) was an agricultural society, with 60-70% of GDP being agricultural (Saito and Takashima, 2016). Of the total GDP, 30-35% was composed of land rents. The distribution of land incomes was the primary source of inequality, and competing interests fought over land rights. In this feudal economy, the main claim over land came from the 300 lords who were given ownership over vast amounts of land by the Tokugawa shogunate, in return for various services. Thus, the lords were the *de jure* owners of land, and had the right to extract land rents in kind and in money. I call this income of the lord "taxation". The lords and the samurai class were separated from the rural economy because they lived in castle town due to an institution known as *Heino-Bunri*. Therefore, the day-to-day maintenance of agricultural land and the collection of these taxes was left to the mostly autonomous peasants.

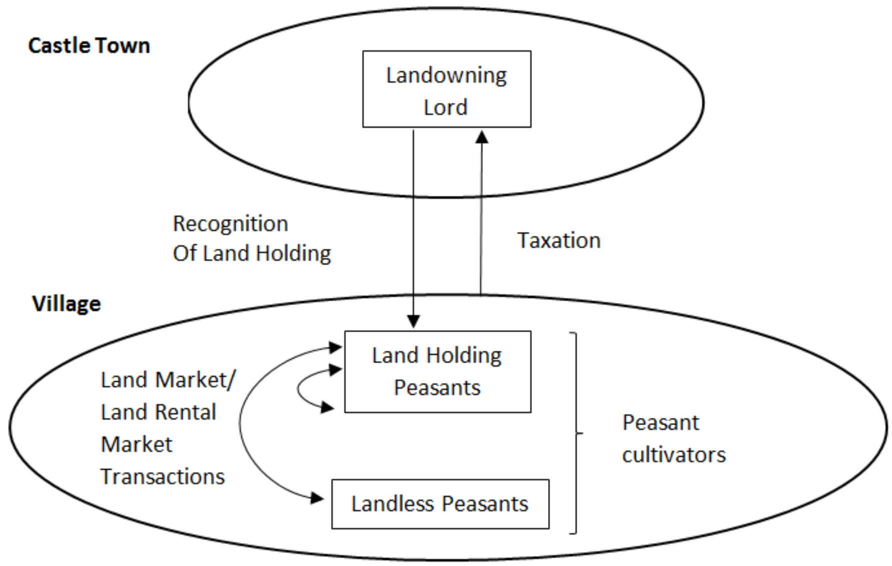

Figure A2: The Japanese Feudal Economy in the Tokugawa Period

In order to collect taxation, the lord had to clarify the liability for taxation and have a broad understanding of the yield within the rural economy. To collect information, the lords conducted large scale cadastral surveys of their lands in the early 17th century and recorded the size and yield of all plots. Taxation was based on the estimated yield. Ultimately, the village had to organize and collect the tax that was demanded by the lord and paid it to the lord (*Murauke-sei*). To facilitate the distribution of tax within the village, a name was attached to each plot in the cadastral survey (the *Naukenin*), and they were deemed responsible for paying the taxation on the plot. However, if individual peasants could not pay their share, others in the village had to compensate for the missing tax.

Within the village, the peasant whose name was attached to the plot was recognized as the *de facto* "owner", and the lord would support the claim if any disputes arose. In general, the lord did not interfere in the land distribution within villages, as long as taxes were paid. The peasant landholder was left with many rights over there landownership, including the sale or rent of the land, and the claim to all land rents that remained after taxation.

Land distribution were always unequal to some extent, resulting in some peasants owner more land than they could cultivate. To resolve this issue, households either employed servants or rented out their excess lands. Land rental markets were established in the early Tokugawa period and were the favored solution to excess land by the end of the Tokugawa period.[19] By the 18th-19th century, these land rental markets were working efficiently, and

[19]Takeyasu (1966) shows how various village records attach different names to the same plot within the same year. He argues that this was due to the cultivator being different to the owner, suggesting the existence of a land rental market.

Arimoto and Kurosu (2015) show that most if not all of the surplus in landownership relative to the family labor force were resolved by land rentals in Northeast Japan. Land sales were also common, and many plots frequently changed hands in the cadastral surveys.[20] The existence of these markets imply two facts. First, land rights were secure enough to allow for the sale of such rights. Second, the positive price attached to land show that the asset gave the owners a positive stream of income implying that the lords had indeed failed to extract all of the land rent as argued above.

The landowning peasant could collect large amounts of land income, but many of these households were still too poor to subsist purely on land incomes. All but the richest cultivated land. Thus, the most common survival strategy by peasants was to cultivate the land they owned (if any) and rent plots from others with a surplus to make ends meet. Although peasants working their own land may not have thought of their extra incomes from landownership as land incomes, they certainly earned implicit land incomes. Therefore, I do not differentiate between land incomes earned from renting plots to others and implicit land incomes attained from farming owned plots.

I summarize the feudal economy using my terminology in Figure A2. Although various feudal economies had differing features, many shared the fact that land rents was distributed between peasants and lords. Furthermore, peasants often had the ability to informally sell or rent land that they owned. This can be seen in some estates of imperial Russia on the eve of emancipation, or in medieval England where estate records show land transactions among peasants from at least the 13th century.[21] Feudal lords were never powerful enough to extract all of the land rent. Hence, it is no surprise that Japanese peasants were earning land incomes under a Feudal regime.

D Age at Marriage

Age at marriage can be found in the panel data but not in the other data as they are inconsistently listed. Therefore, I estimate the age at first birth as an alternative proxy. This is defined as the age of the husband or wife minus the age of the oldest child. To avoid cases where the oldest child has already left the household, I further limit the sample to those households where the oldest child is less than age ten. I regress these dependent variables on landownership (and not its square as there is no reason to look for concavity here). I use a village fixed effect in the case of the panel data due to low numbers of observations of marriages in any village year. I use a village-year fixed effect for the other 351 villages.

[20] Takeyasu (1969) shows that land was frequently changing hands as early as the 17t century.
[21] (Dennison, 2011) Chapter 5

Table A1: Age at Marriage Estimates

	Age at Marriage (Women)			Age at Marriage (Men)		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS 351 Villages	OLS	IV	OLS 351 Villages
Landownership	-0.037	0.021	-0.029***	-0.130	-0.144	-0.030**
	(0.076)	(0.089)	(0.010)	(0.123)	(0.148)	(0.012)
Village-Year FE	No	No	Yes	No	No	Yes
Village FE	Yes	Yes	No	Yes	Yes	No
N	463	463	3193	344	344	3823
Adj-R^2	0.317	0.315	0.097	0.261	0.261	0.106
Mean Dep. Var.	22.924	22.924	24.827	28.241	28.241	31.631

Standard errors are robust and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable is a dummy for deaths. The IV is lagged landownership and it square with differing lags as indicated. I only use the sample from Hanakuma village with reliable death statistics.

The results are shown in table A1. It shows negative but insignificant coefficients for the panel data sample. This may be due to a large standard error due to low sample size of 437 and 344 for women and men respectively. There is a significant effect when looking at the other villages. However, the effect is small as a landowners with 4 *koku* of land would have their first child -0.12 years earlier. Further, the age at first birth includes effects of mortality of children which could potentially explain these results.

E Robustness Tests

E.1 Different Lags as Instruments

I use lags of up to 30 years as an IV to test the main results in the paper related to mortality and fertility. The main results are unchanged for fertility with significance in all cases. Regarding deaths, I generally find a negative but insignificant coefficient.

Table A2: Regressions of Number of Births on Landownership, with various lags as IVs

	(1) 5 Years	(2) 10 Years	(3) 15 Years	(4) 20 Years	(5) 25 Years	(6) 30 Years
Landownership	7.520***	8.154***	11.614***	13.760***	15.343***	18.188***
	(2.051)	(2.323)	(2.926)	(3.922)	(5.031)	(6.856)
$Landownership^2$	-0.164	-0.208	-0.413**	-0.613**	-0.666*	-0.833*
	(0.116)	(0.137)	(0.189)	(0.268)	(0.362)	(0.485)
Village-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	11478	10031	8655	7334	6324	5539
Adj-R^2	0.013	0.012	0.012	0.012	0.010	0.010
p-val joint sig.	0.000	0.001	0.000	0.001	0.003	0.009
Mean Dep. Var.	84.335	86.731	87.926	87.128	92.188	92.616

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable is the number of births in that year. The IV is lagged landownership and it square with differing lags as indicated. I only use the sample from Hanakuma village with reliable death statistics.

Table A3: Regressions of Mortality on Landownership, with various lags as IVs

	(1) 5 Year	(2) 10 Year	(3) 15 Year	(4) 20 Year	(5) 25 Year	(6) 30 Year
Landownership	-0.876*	-0.528	-0.574	-0.187	-1.120	0.490
	(0.504)	(0.540)	(0.757)	(1.114)	(1.544)	(1.754)
$Landownership^2$	0.067***	0.049*	0.062	0.049	0.100	-0.029
	(0.023)	(0.029)	(0.043)	(0.077)	(0.110)	(0.129)
Age/Sex Controls	Yes	Yes	Yes	Yes	Yes	Yes
Village-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	50763	44245	37780	31422	26971	23710
Adj-R^2	0.031	0.031	0.034	0.036	0.031	0.028
p-val joint sig.	0.072	0.309	0.424	0.843	0.460	0.782
Mean Dep. Var.	23.127	22.579	22.552	22.564	22.246	21.932

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable is a dummy for death. The IV is lagged landownership and it square with differing lags as indicated. I only use the sample from Hanakuma village with reliable death statistics.

E.2 IV Regression with Fixed Effects

I estimate specification 11 with an additional household fixed effect in order to compare differences within the same household over time. I find the main results generally do not change. A positive effect generally remains for fertility while the negative effect of mortality is mostly insignificant.

Table A4: Fixed Effects regression of Landownership and Fertility

	Number of Births		Number of Children w. Age $\leq$ 15	
	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Landownership	10.459**	21.549*	83.577**	203.467*
	(5.239)	(11.960)	(38.849)	(120.016)
$Landownership^2$	-0.120	-0.891*	-1.948	-9.427*
	(0.316)	(0.540)	(1.564)	(5.319)
Village-Year FE	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes
N	8655	8655	8655	8655
Adj-R^2	0.024	0.022	0.357	0.342
p-val joint sig.	0.055	0.071	0.034	0.088
Mean Dep. Var.	87.926	87.926	1114.269	1114.269

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$. *Notes: The dependent variable is the number of births. The IV is lagged landownership and it square.*

Table A5: Fixed Effects regression of Landownership and Mortality

	Deaths		Deaths + Potential Deaths	
	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Landownership	0.458	6.763	-4.167**	1.212
	(1.673)	(4.405)	(1.663)	(4.712)
$Landownership^2$	-0.052	-0.470***	0.246**	0.062
	(0.065)	(0.169)	(0.097)	(0.226)
Age-Sex Controls	Yes	Yes	Yes	Yes
Village-Year FE	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes
N	5869	5869	14749	14749
Adj-R^2	0.036	0.033	0.041	0.039
p-val joint sig.	0.770	0.113	0.012	0.815
Mean Dep. Var.	26.204	26.204	24.358	24.358

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$. *Notes: The dependent variable is the number of deaths and potential deaths defined as all cases of individual disappearances for which there is no explanation. The IV is lagged landownership and it square.*

E.3 Housing Area

I additionally use the area of housing as an instrument to account for measurement error. As an alternative measure of household wealth, it should be a valid IV. I find the results are very similar to those in the main body of the paper.

Table A6: Landownership and Fertility with Housing Area IV

	Number of Births		Number of Children w. Age $\leq$ 15	
	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Landownership	12.467***	13.782**	88.762***	125.788**
	(3.791)	(5.386)	(33.620)	(53.376)
$Landownership^2$	-0.389	-0.448	-0.754	-3.162
	(0.282)	(0.465)	(1.876)	(4.101)
Village-Year FE	Yes	Yes	Yes	Yes
N	4742	4742	4742	4742
Adj-R^2	0.019	0.019	0.097	0.095
p-val joint sig.	0.002	0.015	0.012	0.024
Mean Dep. Var.	87.926	87.926	1114.269	1114.269

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable is the number of births. The IV are the quadratics of lagged landownership and housing area.

Table A7: Landownership and Mortality with Housing Area IV

	Deaths		Deaths + Potential Deaths	
	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Landownership	-4.376	-7.982	0.217	0.365
	(4.661)	(7.876)	(0.973)	(1.609)
$Landownership^2$	0.284	0.460	-0.047	-0.049
	(0.300)	(0.497)	(0.053)	(0.108)
Age-Sex Controls	Yes	Yes	Yes	Yes
Village-Year FE	Yes	Yes	Yes	Yes
N	752	752	8184	8184
Adj-R^2	-0.003	-0.004	0.005	0.005
p-val joint sig.	0.350	0.313	0.796	0.809
Mean Dep. Var.	26.204	26.204	24.358	24.358

Standard errors are clustered by household and in parentheses. $*p < 0.10, **p < 0.05, ***p < 0.01$.
Notes: The dependent variable is a dummy for deaths. The IV are the quadratics of lagged landownership and housing area.

F Data Sources

In addition to the DANJURO dataset, the following sources were digitized. Atsugi shi

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Chiba kenshi hensan shingikai (1969) “Chiba ken shiryou 2” *Chiba ken*

Ebina shi (1994) “Ebina shishi shiryō hen kinsei 1” *Ebina shi*

Ebina shi (1996) “Ebina shishi shiryō hen kinsei 1” *Ebina shi*

Enzan shishi hensan iinkai (1995) “Enzanshishi shiryōhen 2” *Enzan shi*

Fukukawa shishi hensan iinkai (2004) “Furukawa shishi 8” *Furukawashi*

Fujimi shishi kyōiku iinkai (1990) “Fujimi shishi shiryōhen 4” *Fujimi shishi*

Fujino machi (1994) “Fujino machishi shiryō hen jyō” *Fujino machi*

Fujioka shishi hensan iinkai (1990) “Fujioka shishi shiryō hen kinse” *Fujioka shi*

Fujiidera shi (1985) “Fujiidera shishi 7” *Fujiidera shi*

Fukui shi (2004) “Fukui shishi shiryōhen 8” *Fukui shi*

Fukuroi shishi kyōiku iinkai (1975) “Fukuroi shishi shiryō 2” *Fukuroi shishi kyōiku iinkai*

Fukushima ken (1986) “Fukushima kenshi 10 jyō” *Rinsen shoten*

Fukushima ken (1986) “Fukushima kenshi 10 ge” *Rinsen shoten*

Fukushima shishi hensan iinkai (1968) “Fukushima shishi 8” *Fukushima shi kyōiku iinkai*

Fukushima shishi hensan iinkai (2000) “Fukushima shishi shiryō sōsho 76” *Fukushima shi kyōiku iinkai*

Futsu shishi hensan iinkai “Futsu shishi shiryō shū 1” *Futsu shi*

Gifu ken (1968) “Gifu kenshi shiryōhen kinsei 4” *Gifu ken*

Gifu shi (1978) “Gifu shishi shiryō hen kinsei 2” *Gifu shi*

Haibara chōshi hensan iinkai (1992) “Shizuoka ken Haibara chōshi shiryō 3 jyō” *Haibara chō kyōiku iinkai*

Hanno shishi henshū iinkai (1984) “Hanno shishi shiryōhen 8” *Hanno shi*

Hasuda shishi kyōiku iinkai shakai kyōiku ka (2000) “Hasuda shishi kinsei shiryō hen 1” *Hasuda shishi kyōiku iinkai*

Hidaka shishi henshū iinkai (1996) “Hidaka shishi kinsei shiryō hen” *Hidaka shi*

Hiratsuka shi (1983) “Hiratsuka shishi 3” *Hiratsuka shi*

Honkawane chōshi hensan iinkai (2000) “Honkawane chōshi shiryō hen 2” *Honkawane chō*

Ibaraki kenshi hensan kinsei shi daini bukai (1971) “Ibaraki ken shiryō kinsei shakai keizai hen 1” *Ibaraki ken*

Ibigawa chō (1970) “Ibigawa chō shi shiryōhen” *Ibigawa chō*

Imaichi shishi hensan senmon iinkai (1973) “Imaichi shishi shiryō hen kinsei 1” *Imaichi-shi*
Ina sonshi hensan iinkai (2003) “Ina sonshi 3” *Inamura*
Inoue, Kazuo & Gotō, Kazuo (1986) “Mikawa no kuni Hoi chihō shumon ninbetsu aratamechō” *kokusho kankō kai*
Iruma shishi hensan shitsu (1986) “Iruma shishi kinsei shiryō hen ” *Iruma shi*
Iwaki-shishi hensan iinkai (1972) “Iwaki-shishi 9” *Iwaki-shi*
Iwai shishi hensan iinkai (1994) “Iwaishishi shiryō hen kinsei” *Iwaishi*
Iwatsuki shi (1982) “Iwatsuki shishi kinsei shiryō hen 4” *Iwatsuki shi*
Izumozaki chōshi hensan iinkai (1988) “Izumozaki chōshi shiryō hen 2” *izumozaki chō*
Kamifukuoka shishi hensan iinkai (1997) “Kamifukuoka shishi shiryōhen 2” *Kamifukuoka shi*
Kamogawa shishi hensan iinkai (1991) “Kamogawa shishi shiryōhen kinsei 1” *Kamogawa shi*
Kanuma shishi hensan iinkai (2002) “Kanuma shi kinsei 2 bessatsu” *Kanuma shi*
Kanagawa ken kenminbu kenshi henshū shitsu (1973) “Kanagawa kenshi shiryōhen 6” *Kanagawa ken*
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Kaizu chō (1970) “Kaizu chōshi shiryōhen 2” *Kaizu chō*
Kashiwa shi hensan iinkai (1970) “Kashiwa shi shiryōhen 7” *Kashiwa* Kawaguchi shi (1985) “Kawaguchi shishi kinsei shiryō 1” *Kawaguchi shi*
Kawajima chō (2005) “Kawajima chōshi shiryōhen kinsei 1” *Kawajima chō*
Kawamata chō kyōiku iinkai “Kawamata chōshi shiryō 5” *Kawamata chō*
Kazo shishi hensanshitsu (1984) “Kazo shishi shiryōhen 1” *Kazo shi*
Komae shi (1979) “Komae shi shiryōshū 9” *Komae shi*
Kōri chōshi hensan iinkai (1992) “Kōri chōshi 6” *Kōri chōshi shuppan iinkai*
Kōriyama shi (1981) “Kōriyama shishi 8” *Kōriyama shi*
Kosai shishi hensan iinkai (1979) “Kosai shishi shiryōhen 1” *Kosai shi*
Koshigaya shi (1974) “Koshigaya shishi 6” *Koshigaya shi*
Kuki shi kyōiku iinkai (2013) “Kuki shi Kurihashi chōshi” *Kuki shi kyōiku iinkai*
Makabe machishi hensan iinkai (1990) “Makabemachi shiryō kinsei hen 3” *Makabe machi*
Matsubara shishi hensan iinkai (1974) “Matsubara shishi 4” *Matsubara shi*
Mino kashige shishi (1977) “Mino kashige shishi shiryō hen” *Mino kashige shi*
Minō shishi henshū iinkai (1970) “Minō shishi shiryō hen 4” *Minō shi*
Miyama chōshi hensan iinkai (1973) “Miyama chōshi shiryōhen” *Miyama chō*
Misato shishi hensan iinkai (1990) “Misato shishi 2” *Misato shi*
Miyamura shi henshū iinkai (2003) “Miyamura shi shiryōhen 1” *Miyamura*

Monzen chōshi hensan senmon iinkai "Shinshū Monzen chōshi shiryō hen 3" *Ishikawa ken Monzen machi*

Motosu chō (1975) "Motosu chōshi shiryōhen" *Motosu chō*

Nagano ken (1973) "Nagano kenshi kinsei shiryō hen 5-1" *Nagano kenshi kankō iinkai*

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Nagano ken (1977) "Nagano kenshi kinsei shiryō hen 4-1" *Nagano kenshi kankō iinkai*

Nagano ken (1978) "Nagano kenshi kinsei shiryō hen 2-1" *Nagano kenshi kankō iinkai*

Nagano ken (1981) "Nagano kenshi kinsei shiryō hen 7-1" *Nagano kenshi kankō iinkai*

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Nagareyama shiritsu hakubutsukan (1987) "Nagareyama shishi kinsei shiryō hen 1" *Nagareyama shi*

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Namioka chō shi hensan iinkai (1982) "Namioka chō shi shiryō hen" *Namioka chō*

Narashino shishi henshū iinkai (1986) "Narashino shishi 2" *Narashino shi*

Narita shishi hensan iinkai (1977) "Narita shishi kinsei hen shiryōshū 4 ge" *Narita shi*

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Nitta chōshi hensanshitsu (1987) "Nitta chōshi 2" *Nitta chō*

Ōgaki shi (1968) "Shinshū Ōgaki shishi shiryō hen 1" *Ōgaki shi*

Ōgaki shi (2010) "Ōgaki shishi shiryōhen kinsei 2" *Ōgakishi*

Ogawa chō "Ogawa chō no rekishi shiryō hen 4" *Ogawa chō*

Oguchi sonshi hensan senmon iinkai (1978) "Oguchi sonshi 1" *Oguchi mura*

Ōhara chōshi hensan iinkai (1988) "Ōhara chōshi shiryōshū 1" *Ōhara chō*

Ōhara chōshi hensan iinkai (1989) "Ōhara chōshi shiryōshū 2" *Ōhara chō*

Ōimachi shi (1988) "Ōimachi shi shiryōhen 2" *Ōimachi*

Okegawa shi (1982) "Okegawa shishi 4" *Okegawa shi*

Ōmiya chōshi hensan iinkai (1979) "Ōmiya chōshi shiryō hen" *Ōmiya machi*

Ono chō (1988) "Ono chōshi shiryōhen 1 ge" *Ono chō*

Ōta kushi shiryōhen hensan iinkai (1997) "Ōta kushi shiryōhen Hirakawa ke monjyo 3" *Tōkyō*

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Ōta shi (1978) “Ōta shishi shiryō hen kinsei 1” *Ōta shi*
Otowa chōshi hensan iinkai (2001) “Otowa chōshi shiryōhen 2” *Otowa chō*
Oume shi goudo hakubutsukan (1986) “Oume shishi shiryōshū 36” *Oume shi*
Ryoukami sonshi hensan iinkai (1989) “Ryoukami sonshi shiryō hen 4” *Ryoukami son*
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Shinpen Okazaki shishi hensan iinkai (1983) “Shinpen Okazaki shishi 7” *Okazaki shi*
Shinpen toyokawa shishi henshū iinkai (2003) “Shinpen toyokawa shishi 6” *Toyokawa shi*
Shinshū Inazawa shishi hensan kaijimu kyoku (1986) “Shinshū Inazawa shishi shiryōhen 10” *Inazawa shi*
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Shinshyū Neagari chōshi henshyū senmon iinkai (1993) “Shinshyū Neagari chōshi shiryō hen jyō” *Neagari machi*
Shizuoka shi (1975) “Shizuoka shishi kinsei shiryō 2” *Shizuoka shi*
Tarō machi kyōiku iinkai (1993) “Tarō chōshi shiryōsh̄kinsei 4” *Tarō machi kyōiku iinkai*
Taiei chōshi hensan iinkai (1990) “Taiei chōshi shiryōhen 2” *Taiei machi*

Takatomi machi (1977) “Takatomi chōshi shiryō hen” *Takatomi machi*
Tenryū shi (1974) “Tenryu shishi shiryōhen 1” *Tenryū shi*
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Tenryū shi (1977) “Tenryu shishi shiryōhen 4” *Tenryū shi*
Tenryū shi (1978) “Tenryu shishi shiryōhen 5” *Tenryū shi*
Tochigi kenshi hensan iinkai (1975) “Tochigi kenshi shiryō hen kinsei 3” *Tochigi ken*
Tochigi kenshi hensan iinkai (1977) “Tochigi kenshi shiryō hen kinsei 6” *Tochigi ken*
Toda shi (1983) “Toda shishi shiryōhen 2” *Toda shi*
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Tokiwa sonshi hensan iinkai (2003) “Tokiwa sonshi” *Tokiwa mura*
Tōkyō to Shinagawa ku “Shinagawa kushi zoku shiryō hen 1” *Shinagawa ku*
Togane shishi hensan iinkai (1976) “Togane shishi shiryō hen 2” *Togane shiyakusho* Tōkyō toritsu daigaku gakujyutsu kenkyūkai (1970) “Meguro kushi shiryōhen” *Tōkyō to Meguro ku*
Toyota chōshi hensan iinkai (1988) “Toyota chōshi shiryōshū kinsei hen 1” *Toyota machi*
Tsuruga shishi hensan iinkai (1983) “Tsuruga shishi shiryō hen 4 ge” *Tsuruga shi*
Unakami chōshi hensan iinkai (1988) “Unakami chōshi shiryōhen 2” *Unakami machi*
Urawa shi sōmubu shishi hensan shitsu (1986) “Urawa shishi 3” *Urawa shi*
Utsunomiya shishi (1980) “Utsunomiya shishi 4” *Utsunomiya shi*
Nakajyō chōshi hensan iinkai (1984) “Nakajyō chōshi shiryō hen 2” *Nakajyō chō*
Wakō shi (1982) “Wakō shishi shiryō hen 2” *Wakō shi*
Wajima shishi hensan senmon iinkai (1972) “Wajima shishi shiryōhen 2” *Wajima shi*
Yachiyo shi hensan iinkai (1989) “Yachiyo shi no rekishi shiryō hen kinsei 1” *Yachiyo shi*
Yamagata ken (1976) “Yamagata kenshi shiryōhen 16” *Yamagata ken*
Yamagata ken (1983) “Yamagata kenshi shiryōhen 18” *Yamagata ken*
Yokawa chōshi henshū iinkai (1993) “Yokawa ch$\bar{0}$shi shiryōshū 2” *Yokawa chō kyōiku iinkai*
Yokkaichi shi (1993) “Yokkaichi shi 9” *Yokkaichi shi*
Zushi shi (1988) “Zushi shishi shiryō hen 2” *Zushi shi*