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PhD thesis

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Essays on Demography, Social Mobility, and the Development of the Welfare State

- A Historical Perspective

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Contents

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Summary

This dissertation is comprised of four self-contained chapters in different fields of economics. The first chapter is a theoretical paper presenting an overlapping generations model examining the effects of increased life expectancy on the choices of length of schooling and retirement age. The remaining three chapters are within the field of economic history. They are empirical in nature, concerning historical developments in England before and during industrialization.

Chapter 1, "*Life Expectancy, Schooling and the Lifetime Supply of Labour*", examines the effects of increased life expectancy on the length of the work life. It is often conjectured that an increase in life expectancy will increase educational attainment. Going back to Ben-Porath (1967), the idea is that a longer time horizon increases the recovery period of human capital investments, thereby making it more viable to invest in education. Indeed there is a strong correlation between life expectancy and schooling, such that the Ben-Porath mechanism has been widely used in growth theory and related literature when examining the effects of prolonged life expectancy. The original Ben-Porath mechanism, however, concerns the length of work life and not the length of life per se. Hazan (2009) shows that theoretically an increase in lifetime will increase schooling but the length of the worklife will stay unchanged as the retirement increases proportionally with schooling. Empirically, however, he finds that the length of worklife in fact decreased for men born in the U.S. between 1840 and 1930. He therefore concludes that the Ben-Porath mechanism cannot be responsible for the increase in educational attainment since the implied increase in the retirement age cannot be observed. The theoretical model presented in Hazan (2009) takes lifetime as certain. Realistically, however, one cannot be certain about length of life when making decisions about length of education and time of retirement. I show that, taking uncertainty into account, educational attainment increases upon an increase in life expectancy even if the retirement age is reduced. Thus, the empirical observation of falling lifetime labour supply and increasing educational attainment can be reconciled.

Chapter 2, "*Survival of the richest? Social status, fertility and social mobility in England 1541-1824*" (joint with Paul Sharp and Jacob Weisdorf), uses data collected by the Cambridge Group to investigate and explain differences in fertility by socio-economic group in pre-industrial England. As hypothesised by Clark (2007), the wealthier groups of society had higher fertility rates historically. Due to the static nature of pre-

industrial society, higher fertility of the rich leads to a situation of constant downward mobility, as there is 'not enough room at the top'. We find, in line with results presented by Greg Clark, that wealthier groups did indeed have higher fertility until the 1700s. We demonstrate that this had to do with earlier age at marriage for women, evidence for the European marriage pattern. We then turn to the likely social and economic impact of this, considering Clark's hypothesis that downward mobility of the richer groups implied that 'middle class values' spread through English society prior to the industrial revolution. Through the construction of social mobility tables, we demonstrate that the children of the rich were indeed spreading through society, but they were small in number relative to poorer sections of society. Moreover, the children of the poor were also entering the middle classes as there was also a considerable degree of upward mobility. Due to the smaller size of the richer groups, this upward mobility might potentially have had a greater impact on the richer groups than the downward mobility of rich children might have had on the poorer groups. We thus find evidence for the suggested fertility pattern, however the consequences of this pattern are less clear.

Chapter 3, "*North and South: More Evidence for the Social Mobility-Welfare Nexus from Historical England*" (joint with Paul Sharp), picks up on the analysis of social mobility of the previous chapter. Piketty (1995) formalizes the idea that historically high levels of social mobility can lead to a culture of non-acceptance of redistribution and welfare provision. We examine this hypothesis using data for historical England, where welfare provision was determined at the local level, allowing us to test the hypothesis within a single country, thereby controlling for country specific differences. England is an interesting case, as it has previously been noted that, the North and the South of England were culturally very different, with less acceptance of welfare in the North. Historically, this is reflected by lower levels of poor relief spending in the early nineteenth century, which under the Poor Laws was decided at the parish level. We use the Cambridge Group data to test the Piketty hypothesis by looking at social mobility on a subnational level. We measure mobility using the method developed by Altham (1970) and estimate the intergenerational elasticity of earnings, matching the occupational records with existing wage data. Irrespective of the method used, we indeed find higher levels of mobility in the North during the period 1550-1850. We thus provide evidence for the link between mobility and welfare spending, consistent with the Piketty hypothesis.

Chapter 4, "*Does Welfare Spending Crowd Out Charitable Activity? Evidence from Historical England under the Poor Laws*" (joint with Paul Sharp), continues on the line of chapter 3 making use of the fact that welfare provision under the Old Poor Laws was decided on the parish level. This paper examines the relationship between government spending and charitable activity. It is often suggested that, both in an intertemporal as well as in a cross-country perspective, public welfare provision will crowd out private donation. Along these lines a larger private sector providing welfare services in the US, compared to European countries, would be explained by a smaller government. Similarly, public spending cuts are often justified with an encouragement that private charities will take over. Whereas the theoretical literature predicts crowding out, the empirical literature is rather inconclusive. We present a novel way of testing the 'crowding out hypothesis', where the period of the Old Poor Laws gives us the heterogeneity we need to test for the impact of different levels of welfare support within a single country. Using additional data on charitable income by county, we find a positive relationship: areas with more public provision also enjoyed higher levels of charitable income. These results hold when instrumenting for Poor Law spending using the distance to London and historical migration to London as well as when looking at first differences.

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Resumé

Denne afhandling består af fire selvstændige kapitler inden for to forskellige områder af økonomi. Det første kapitel er et teoretisk papir som præsenterer en model med overlappende generationer og som analyserer effekterne af forlænget levetid på beslutningerne vedrørende uddannelseslængden og pensionsalderen. De resterende tre kapitler benytter en empirisk tilgang og omhandler emner inden for økonomisk historie i England, før og under industrialiseringen.

Kapitel 1, "*Life Expectancy, Schooling and the Lifetime Supply of Labour*", undersøger effekterne af øget forventet levetid på længden af arbejdslivet. Idéen om at en forøgelse i den forventede levetid vil føre til et stigende uddannelsesniveau går tilbage til Ben-Porath (1967), som foreslår at en længere tidshorisont forlænger tilbagebetalingsperioden af den investering man foretager i uddannelsen, hvilket gør det mere rentabelt at investere i uddannelse. Empirisk set er der en stærk korrelation mellem forventet levetid og uddannelse, således at Ben-Porath mekanismen ofte bliver brugt i vækstteori og anden relateret litteratur, som beskæftiger sig med effekterne af forlænget levetid. Dog omhandler den oprindelige Ben-Porath mekanisme længden af arbejdslivet og ikke længden af livet i sig selv. Hazan (2009) viser teoretisk, at en forlængelse af levetiden øger uddannelsesniveauet, men at længden af arbejdslivet er uændret da pensionsalderen forøges proportionalt. Empirisk kan dette dog ikke bekræftes, da han finder, at længden af arbejdslivet de facto er faldet for mænd født i USA i perioden 1840-1930. Hazan konkluderer dermed, at det ikke kan skyldes Ben-Porath mekanismen, at uddannelseslængden er steget over samme periode. I den teoretiske model i Hazan (2009) er levetiden kendt. Realistisk set kender vi dog ikke levetiden når vi tager beslutninger omkring uddannelseslængde og pensionsalder. Jeg viser, at når vi tager højde for usikkerheden i levetiden, stiger uddannelseslængden, selv når pensionsalderen falder. Dermed kan de empiriske observationer af reduceret arbejdsudbud og øget uddannelse forenes.

Kapitel 2, "*Survival of the richest? Social status, fertility and social mobility in England 1541-1824*" (med Paul Sharp og Jacob Weisdorf), bruger data indsamlet af Cambridge gruppen og undersøger samt forsøger at forklare fertilitetsforskelle mellem forskellige socioøkonomiske grupper i England før industrialiseringen. Clark (2007) opstiller hypotesen, at de rigere grupperinger af samfundet, historisk set, havde højere fertilitetsrater. Da samfundet samtidig var statisk i forhold til den erhvervsmæssige sammensætning, betød den højere fertilitet en konstant nedadgående social mobilitet for de riges børn. Vi finder, i

overensstemmelse med resultaterne i Clark (2007), at de rigere grupperinger af samfundet havde højere fertilitet indtil 1700-tallet. Vi viser, at dette skyldtes en lavere giftealder for kvinder, evidens for 'European marriage pattern' (som siger, at fertilitet historisk blev begrænset i gennem senere ægteskab). Vi undersøger derefter de sociale og økonomiske konsekvenser af dette fertilitetsmønster - i forhold til Clarks hypotese om, at den nedadgående sociale mobilitet førte til en udbredelse af særlige middelklasseværdier før den industrielle revolution. Ved brug af social mobilitets tabeller viser vi, at de riges børn var mobile nedadgående, men at de var meget begrænsede i antallet i forhold til de fattigere grupperinger af samfundet. Desuden observerer vi også i høj grad opadgående social mobilitet, således at børn af fattigere forældre også kom ind i middelklassen. Da de rigere grupperinger var relativ små, havde denne opadgående mobilitet potentielt højere absolut betydning end den nedadgående mobilitet af de riges børn. Vi finder dermed evidens for det formodede fertilitetsmønster, men konsekvenserne af dette er mere uklare.

Kapitel 3, "*North and South: More Evidence for the Social Mobility-Welfare Nexus from Historical England*" (med Paul Sharp), tager analysen af social mobilitet fra det forrige kapitel videre. Piketty (1995) opstiller en model, som formaliserer idéen om, at høje historiske rater af social mobilitet kan medføre en kultur af mindre accept af omfordeling og velfærdsydelser. Vi undersøger denne hypotese med historisk data fra England, hvor velfærdsydelser bestemtes lokalt, hvilket giver os mulighed for at teste hypotesen indenfor ét land. Dermed kan vi kontrollere for landespecifikke forskelle. England er især interessant, da der har været, og stadig er, store kulturelle forskelle mellem Nord- og Sydengland, med mindre accept af velfærd i Nordengland. Dette afspejles historisk i lavere fattighjælpsydelser (poor relief) i starten af det nittende århundrede, som blev bestemt på sogneniveau under 'Poor Law'-systemet. Vi bruger data fra Cambridge gruppen for at teste Piketty hypotesen, hvor vi ser på social mobilitet på regional basis. Vi bruger metoden beskrevet i Altham (1979) for at måle social mobilitet, og vi estimerer indkomstelasticiteten på tværs af generationer ved at kombinere erhvervsregistreringerne med eksisterende løndata. Uanset metoden finder vi højere social mobilitet i Nordengland i perioden 1550-1850. Dermed viser vi ny evidens for Piketty hypotesen og linket mellem mobilitet og velfærdsydelser.

Kapitel 4, "*Does Welfare Spending Crowd Out Charitable Activity? Evidence from Historical England under the Poor Laws*" (med Paul Sharp), gør fortsæt brug af det faktum, at velfærdsydelser blev bestemt på sogneniveau under 'Poor Law'-systemet. Denne artikel undersøger forholdet mellem offentlige velfærdsydelser og privat velgørenhed. Der er en generel formodning om, at offentlige ydelser fortrænger private donationer (crowding out), både over tid og på tværs af lande. På baggrund af dette vil man for eksempel forklare USA's større private velfærdssektor, sammenlignet med Europæiske lande, med en mindre udviklet velfærdsstat. Tilsvarende, berettiges offentlige besparelser ofte med argumentet om, at den private sektor vil overtage de nødvendige ydelser. Den teoretiske litteratur forudsiger ’crowding out’, mens resultater af den empiriske litteratur er mindre tydelige. Mange studier finder en negativ sammenhæng, men lige så mange finder ingen eller en positiv sammenhæng. Vi præsenterer i denne artikel en ny måde at teste ’crowding out’-hypotesen, hvor ’Poor Law’-systemet giver os den nødvendige heterogenitet for at teste effekten af offentlige velfærdsydelser på private donationer indenfor ét land. Ved at kombinere data for fattighjælp med data for indkomst af velgørenhedsorganisationer (charitable trusts), finder vi en positiv sammenhæng: steder med højere offentlige ydelser til de fattige havde også højere velgørenhed. Dette resultat holder, både når vi instrumenterer for offentlig fattighjælp med afstanden til London og historiske migrationsrater til London, og når vi ser på ændringer over tid.

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Chapter 1

Life Expectancy, Schooling and the Lifetime Supply of Labour

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Life Expectancy, Schooling and the Lifetime Supply of Labour *

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Abstract

Hazan (2009) shows that theoretically an increase in lifetime will increase schooling but the length of the worklife will stay unchanged as the retirement age increases proportionally with schooling. Empirically, however, this finding cannot be confirmed. Actual lifetime labour supply as seen for men born in the U.S. between 1840 and 1930 has in fact fallen. In Hazans model lifetime is certain. In the present paper it is shown that, taking uncertainty into account, educational attainment increases upon an increase in life expectancy even if the retirement age is reduced. Thus, the empirical observation of falling lifetime labour supply and increasing educational attainment can be reconciled.

JEL classification: D91, I20, J10, J26
Keywords: life expectancy, human capital, retirement, overlapping generations

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1 Introduction

It is often conjectured that an increase in life expectancy will increase educational attainment. Going back to Ben-Porath (1967) the idea is that a longer time horizon increases the recovery period of human capital investment, thereby making it more viable to invest in education. Indeed there is a strong correlation between life expectancy and schooling. Over the last decades life expectancy in the United States has risen from an average of below 50 years in the beginning of the 20th century to almost 80 years today. Over the same time span, also average educational attainment in western countries has increased significantly. In the United States average years of schooling have risen from below 8 years to above 12 years in the 50 years from 1950 to 2000 alone (Barro and Lee, 2001). The Ben-Porath mechanism has been widely used in growth theory and related literature, see for example Kalemli-Ozcan, Ryder and Weil (2000) or Heijdra and Romp (2009a). The original Ben-Porath mechanism, however, concerns the length of work life and not the length of life per se. Hazan (2009) shows that theoretically an increase in lifetime will increase schooling but the length of the worklife will stay unchanged as the retirement increases proportionally with schooling. It is then shown that empirically length of worklife in fact decreased for men born in the U.S. between 1840 and 1930. He therefore concludes that the Ben-Porath mechanism cannot be responsible for the increase in educational attainment since the implied increase in the retirement age cannot be observed. The theoretical model presented in Hazan (2009) takes lifetime as certain. Realistically, however, one cannot be certain about the length of life when making decisions about the length of education and the time of retirement.

Hazan (2009) falls within a literature concerning the relation between life expectancy and educational attainment. Boucekkine, de la Croix and Licandro (2002) present a model including both a choice of education and of retirement as well as a concavely decreasing survival function. The results of this set-up confirm the Ben-Porath mechanism. However, in this model the retirement age is a multiple of the schooling length, such that earlier retirement cannot occur upon an increase in life expectancy. However, in the United States the labour force participation rate of men between 60 and 64 years of age has in fact fallen from 83 percent in 1957 to approximately 58 percent today (Hurd, 2008).[1] Additionally, by using a linear utility function individual consumption paths are indeterminate. The present paper extends this contribution by assuming a concave utility function and shows that the results concerning the retirement decision are largely affected.[2]

Related to the problem of this paper is the work by Sheshinski (2009) and Cervellati and Sunde (2010) as well as Hansen and Lønstrup (2011) and Strulik and Werner (2012). Using a general survival function, Sheshinski (2009) shows that mortality improvements which are concentrated at older ages lead to an increase in schooling and to later retirement. Mortality

[1] Also other theoretical work has shown that the relation between life expectancy and the retirement age is ambiguous, see for example Bloom, Canning, Mansfield and Moore (2007) or Kalemli-Ozcan and Weil (2010).

[2] A similar attempt was made in Echevarria (2004). However, the interaction between the life-cycle decisions of education and retirement was not taken into account.

improvements which are concentrated at younger ages, however, may lead to both an increase or a decrease in schooling, for a given retirement age. By considering mortality improvements taking place at all ages coupled with positive discount rates, the model presented in the paper at hand, however, is able to reproduce the empirically relevant case of increasing educational attainment and earlier retirement, which is not possible with the model presented in Sheshinski (2009). Cervellati and Sunde (2010) show that the conclusions in Hazan (2009) do not hold generally, as the necessary condition for schooling to increase is that the benefits of schooling increase relative to the costs and not an increase in total hours worked. Although the conclusions are similar, the focus of the paper at hand is quite different than that of Cervellati and Sunde (2010). The focus of the model presented here is on the explicit modelling of the retirement decision and the interaction with the schooling decision in the case of increasing longevity. Hansen and Lønstrup (2011) show that when credit markets for the young are absent it can be optimal to increase schooling and reduce the retirement age at the same time, thereby presenting a different kind of mechanism than the paper at hand. Strulik and Werner (2012) show in a three-period overlapping generations model that the length of active life can decrease upon an increase in life expectancy if the labour supply elasticity is high enough.

Assuming a constant instantaneous mortality rate and taking uncertainty into account, this paper shows that educational attainment increases upon an increase in life expectancy even if the retirement age is reduced. Thus, the empirical observations in Hazan (2009) of falling lifetime labour supply and increasing educational attainment can be reconciled. These effects are not due to the traditional Ben-Porath mechanism, as expected work life not necessarily increases. The increase in schooling is rather due to reduced uncertainty of surviving the recovery period of the educational investment. Early retirement can occur, which confirms the importance of taking retirement into account when using the Ben-Porath mechanism in endogenous growth models. One cannot be sure that an increase in life expectancy also increases lifetime labour supply. Nevertheless, the reduction in survival uncertainty seems to be enough to induce higher human capital investment. Thus, it is the increase in the *expected* length of work life that causes a positive relation between life expectancy and schooling. Clearly, this increase in schooling does not imply that the growth effect of increasing life expectancy must be positive, as was often concluded by earlier work. Whether the increase in productivity of the labour force (due to increased education) is large enough to offset a possible decrease in the size of the labour force (caused by longer schooling and early retirement) is unclear. This might also help to explain empirical difficulties to reconcile a positive effect of life expectancy on economic growth across countries (see for example Acemoglu and Johnson (2007), Cervellati and Sunde (2011), and Jayachandran and Lleras-Muney (2009)).

2 The Model

The model presented here is based on Blanchard's perpetual youth model (Blanchard, 1985). In this continuous-time OLG model agents face a positive probability of dying, which is constant through life and the same for all agents. In the original model, agents start working at birth and continue working until death. Here, a more realistic description of the life-cycle is incorporated. Agents can choose to postpone labour market entry through education, then being more productive, and can choose to leave the labour force earlier by retiring at the end of the life-cycle.

2.1 Demography

The description of demography is the same as in the original Blanchard model. Thus, all agents face the same, constant probability of dying and the population is assumed to be stationary. This means that the birth as well as the mortality rate, and thereby also population growth rate, have been constant for a long time. The instantaneous probability of dying will be denoted by μ in the following. Although a death rate which is constant across ages may not be very realistic, it is useful to analyze a change in mortality which takes place with the same magnitude for all ages. As the increase in life expectancy, which has taken place in western countries over the last century and which is of interest here, can be classified as such a change in mortality, the simple death rate can be justified (see also Kalemli-Ozcan et al., 2000). Additionally, agents are in fact born as adults, i.e. when they take decisions concerning education and working life. As it is adult mortality that is the relevant parameter here, the assumption of a constant mortality rate for all adults might not be so inaccurate. The model concerns long-run developments, therefore not including a maximum attainable age in the demographic description seems reasonable. This is especially true since the evidence provided by Oeppen and Vaupel (2002), who report that estimated maximum life expectancies have continuously been crossed over the past 160 years.

Denoting the probability of surviving from the time of birth, s, to time t by $P(t-s)$, this probability can be written as

$$P(t-s) = e^{-\mu(t-s)} \tag{1}$$

Population grows exponentially at rate n. Thus, the size of the total population at time t is given by

$$N(t) = N(0)e^{nt} \tag{2}$$

where N(0) is the size of the initial population at time 0. It is assumed that the flow of newborns is proportional to the existing population at every instant of time, i.e.

$$N(s,s) = bN(s) \tag{3}$$

Here, b is the birth rate. As the population is assumed to be stationary, the population growth rate will be the difference between the birth and the mortality rate. Thus, $n = b - \mu$ will hold at every point in time. The size of a cohort, born at time s and still alive at time t, is then given by

$$N(s,t) = bN(0)e^{ns}e^{-\mu(t-s)} \tag{4}$$

Agents first receive education and only thereafter enter the labour market from which they later retire. Note that, in this set-up of the model, agents will always find it optimal to choose a period of full-time education at the beginning of life, followed by a period of full-time work and finally retreating completely from the labour market. As for education, this is due to the fact that the opportunity cost of studying is lowest in the beginning of life. The foregone wage will be lower in earlier periods as wages grow at the rate of technological progress. Also the retirement decision will optimally be taken once-and-for-all since it is determined by a comparison of the marginal utility of consumption against the marginal disutility of working and the disutility is linearly increasing in age.

2.2 Firms

Markets are assumed to be perfectly competitive. The production function of firms is assumed to have neoclassical properties according to

$$Y(t) = F(K(t), A(t)H(t)) \tag{5}$$

where K(t) is the aggregate capital stock, A(t) is a productivity factor, which is increasing with time, and H(t) is aggregate human capital at time t. More specifically, technology is growing exponentially at rate γ, i.e.

$$A(t) = A(0)e^{\gamma t} \tag{6}$$

and aggregate human capital is given by

$$H(t) = h(t)L(t) \tag{7}$$

where h(t) is average human capital and L(t) denotes the size of the workforce. Aggregating over the workforce only, implies that human capital first becomes accessible after finishing school and is 'depreciated' instantly upon retirement. Here, human capital evolves according to

$$h(t) = \begin{cases} \beta T(s)^{\alpha} & , for \quad s + T(s)^* \leq t \leq s + R(s)^* \\ 0 & , for \quad t \notin [s + T(s)^*; s + R(s)^*] \end{cases} \tag{8}$$

where $\alpha, \beta > 0$ and T(s)* and R(s)* represent the equilibrium ages of finishing education and leaving the labour force as chosen by the individual, which will be discussed later in more detail.

The economy is assumed to be a small open economy. An implication of this assumption is that the interest rate will be exogenously given by the world market. Additionally, this rate is assumed to be positive and constant, denoted by r in the following. As all firms are faced with this same interest rate and are symmetric, all firms will choose the same capital intensity, $\tilde{k}(t) \equiv \frac{K(t)}{A(t)H(t)}$. With a constant interest rate, the chosen capital intensity will also be constant and can be denoted by $\tilde{k}^*$ for all firms. In intensive form the production function can then be written as

$$\tilde{y}(t) = \frac{Y(t)}{A(t)H(t)} = F\left(\frac{K(t)}{A(t)H(t)}, 1\right) = f(\tilde{k}(t)) = f(\tilde{k}^*) \tag{9}$$

Firms are profit maximizing and profits are given by

$$\Pi(t) = Y(t) - w(t)L(t) - (r + \delta)K(t) \tag{10}$$

where $r > 0$ is the interest rate, $\delta > 0$ is the depreciation rate of physical capital and $w(t)$ is the wage rate at time t. Both labour and physical capital are paid the value of their marginal products. With no adjustment costs of capital and labour and no adjustment time, the maximization of profit at every instant in time is the same as maximizing the present value of all future profits. The marginal product of labour is then given by the RHS of (11).

$$\frac{\partial \Pi(t)}{\partial L(t)} = 0 \Rightarrow w(t) = \tilde{w}^* A(t)h(t) \tag{11}$$

defining $\tilde{w}^* \equiv f(\tilde{k}^*) - \tilde{k}^* f'(\tilde{k}^*)$. Thus, $w(t)$ is the wage for a worker with average human capital, h(t). The marginal product of capital is given by the RHS, plus the depreciation rate of capital, of (12).

$$\frac{\partial \Pi(t)}{\partial K(t)} = 0 \Rightarrow r = f'(\tilde{k}^*) - \delta \tag{12}$$

defining the capital intensity, $\tilde{k}^*$, as the interest rate is given exogenously. Capital is rented from insurance companies, which is described in more detail in the next section.

2.3 Insurance Companies

Insurance companies play an important role in two respects in this economy. Firstly, they issue negative life insurance contracts in which agents will place all their savings.[3] These contracts are bought by the agents for one unit of account at some point in time. Thereafter, they pay an interest of the actuarially fair rate every period, whereas at death the financial wealth of the agent is transferred to the insurance company. The actuarially fair rate is comprised of the risk-free rate, given by the world interest rate, plus an actuarial bonus. The insurance company invests all its financial assets in the firms, who are producing the consumption good. This investment is assumed to give a return of the risk-free rate. This

[3] This was first shown by Yaari (1965) and is due to the fact that agents do not leave bequests according to the specification of their preferences.

set-up of negative life-insurance is as in the original Blanchard model.

Here, however, insurance companies additionally issue loans to students in order to finance their education. Due to the specification of preferences agents do not leave bequests and education therefore needs to be financed by borrowing. It is assumed that insurance companies demand the actuarially fair rate as interest on these loans.

The workings of the insurance and loans market is illustrated in Figure 1 below. Here, Z(t) is net liabilities of the insurance companies, given by deposits D(t) less student loans B(t), i.e. $Z(t) \equiv D(t) - B(t)$. The actuarial bonus is, for now, denoted by $\bar{r}$.

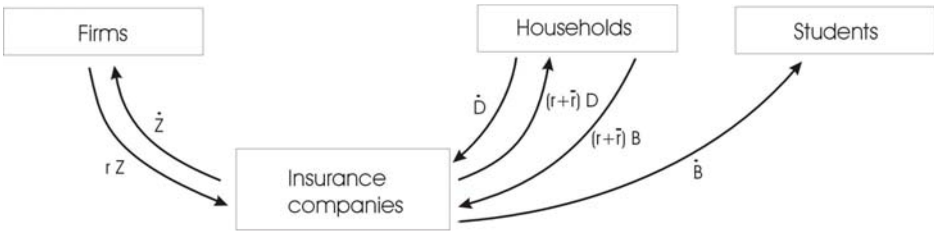


Figure 1: The insurance and loans market

In order to calculate the actuarial bonus, first note that profits of insurance companies at time t, are given by

$$\Pi(t) = rZ(t) - (r+\bar{r})D(t) + (r+\bar{r})B(t) + \mu(L(t)+E(t))\frac{D(t)}{L(t)+E(t)} - \mu S(t)\frac{B(t)}{S(t)} \quad (13)$$

where L(t) is the working population, E(t) is the number of retirees and S(t) denotes the student population. Note that only working agents and retirees possess financial wealth. Therefore, only upon their death, is financial wealth transferred to the insurance companies. Assuming that the insurance company is large, thereby holding deposits from a large number of agents and giving loans to a large number of students, this transfer will equal average financial wealth, equal to $\frac{D(t)}{L(t)+E(t)}$. The death of a student, on the other hand, represents a loss to the insurance company as the student's loan will not be paid back. Again assuming the insurance company is large, it looses the amount of an average student loan, given by $\frac{B(t)}{S(t)}$, upon the death of a student. As the insurance and loans market is assumed to operate under perfect competition, profits will be zero. This allows to calculate the actuarial bonus.

$$\Pi = 0 \quad \Leftrightarrow \quad \bar{r} = \mu \quad (14)$$

In equilibrium, the actuarial bonus is thus equal to the mortality rate, as in the original Blanchard model and as was first shown by Yaari (1965). That this result also holds in the extended modeling of insurance companies presented here, is due to the fact that students have the same probability of dying as all other agents, as well as the assumption that insurance companies demand the actuarially rate on student loans. Then, for a large insurance company, the actuarial bonus will exactly make up the loss of students who die before paying back the loan. The fact that surviving agents pay accumulated interest equal to the actuarially fair rate on their student loans once they start working, leads to an expected return on these loans of exactly the risk-free rate.

2.4 Households

An agent chooses a consumption path, how much time to spend in education as well as when to retire. The retirement decision is modeled by agents incurring disutility from working as well as from studying. It is assumed that this disutility is increasing in age as it becomes more tiresome for the agent to study or work, the older he gets. Another interpretation would be that the agent values free time during the entire life, but even more so at older ages. Furthermore, it is assumed that the utility function is additively separable in consumption and labour supply. Moreover, utility is assumed to be logarithmic. This eases the analysis, as the retirement decision does not depend on the level of the wage rate under this assumption. Then, the expected lifetime utility of an agent born at time s, and as seen from the time of birth, is given by

$$U(s) = \int_s^\infty ln(c(s,t))e^{-(\rho+\mu)(t-s)}dt - \int_s^{s+R(s)} \epsilon \cdot (t-s)e^{-(\rho+\mu)(t-s)}dt \tag{15}$$

where $\rho > 0$ is the pure rate of time preference. The term $\epsilon \cdot (t-s)$ reflects the disutility derived from work or study, where $\epsilon > 0$ is a constant disutility parameter and disutility is thereby linearly increasing in age.

Agents can either consume or save their labour income for later consumption. Thus, the agent's intertemporal budget constraint (IBC), as seen from time of birth s, is given by

$$\int_s^\infty c(s,t)e^{-(r+\mu)(t-s)}dt \leq a(s,s) + \int_{s+T(s)}^{s+R(s)} w(t)e^{-(r+\mu)(t-s)}dt \tag{16}$$

where $a(s,s)$ is the agent's initial financial wealth and $w(t)$ is labour income at time t.

The agent chooses a value for T(s) and R(s), i.e. decides length of education and retirement age, as well as a time path of consumption. These decisions are taken such as to maximize utility, (15), subject to the budget constraint, (16). The Lagrangian for this maximization problem is then given by

$$\begin{aligned}\mathscr{L}(s) = &\int_s^\infty ln(c(s,t))e^{-(\rho+\mu)(t-s)}dt - \int_s^{s+R(s)} \epsilon \cdot (t-s)e^{-(\rho+\mu)(t-s)}dt \\ &- \lambda\left(\int_s^\infty c(s,t)e^{-(r+\mu)(t-s)}dt - a(s,s) - \int_{s+T(s)}^{s+R(s)} \beta T(s)^\alpha A(t)\tilde{w}^* e^{-(r+\mu)(t-s)}dt\right)\end{aligned} \tag{17}$$

where the first-order conditions with respect to the three decision variables are

$$\frac{\partial \mathscr{L}(s)}{\partial c(s,t)} = 0 \quad \Rightarrow \frac{1}{c(s,t)}e^{(r-\rho)(t-s)} = \lambda \tag{18}$$

$$\frac{\partial \mathscr{L}(s)}{\partial T(s)} = 0 \quad \Rightarrow T(s) = \frac{\alpha}{r+\mu-\gamma}\left(1 - e^{-(r+\mu-\gamma)(R(s)-T(s))}\right) \tag{19}$$

$$\frac{\partial \mathscr{L}(s)}{\partial R(s)} = 0 \quad \Rightarrow \epsilon \cdot R(s) = \lambda w(s+R(s))e^{-(r-\rho)R(s)} \tag{20}$$

Here, it is assumed that $r + \mu > \gamma$ to ensure a meaningful equilibrium. The transversality condition, $lim_{t\to\infty} a(s,t)e^{-(r+\mu)t} = 0$, ensures an equilibrium trajectory. (19) can be interpreted as the condition that the length of education is chosen such that the marginal cost of education, time and thus the foregone wage, is equal to its marginal benefit, the discounted stream of extra earnings, $\frac{\alpha}{r+\mu-\gamma}$, adjusted for the length of the working life, R(s)-T(s). (20) gives the intuitive condition that, at the date of retirement, the disutility of work should equal the marginal utility of extra consumption financed by the additional wage income if the agent kept on working.

By differentiating (18) with respect to time, we see that the growth rate of individual consumption is given by the Keynes-Ramsey rule. Thus,

$$\frac{\dot{c}(s,t)}{c(s,t)} = r - \rho \equiv g \tag{21}$$

for any T(s) and R(s). Assuming that $r > \rho$, which implies that the economy is populated by relatively patient agents, this growth rate will be positive. Note that this growth rate does not depend on the mortality rate. This is due to the fact that agents can fully insure themselves against the risk of dying by purchasing negative life insurance. Furthermore, it is worth noting that the consumption growth rate is the same for all agents, independent of the time of birth.

Note that the initial level of consumption can now be written as

$$c(s,s) = (\mu+\rho)\cdot v(s,s) \tag{22}$$

where human wealth at time of birth, v(s,s), can be simplified to

$$\begin{aligned} v(s,s) &= \int_{s+T(s)}^{s+R(s)} w(t)e^{-(r+\mu)(t-s)}dt \\ &= \frac{1}{r+\mu-\gamma} w(s)\left(e^{-(r+\mu-\gamma)T(s)} - e^{-(r+\mu-\gamma)R(s)}\right) \end{aligned} \tag{23}$$

Inserting (22) and (23) into (20), we get

$$R(s) = \frac{(r+\mu-\gamma)e^{-(g-\gamma)R(s)}}{\epsilon(\mu+\rho)\left[e^{-(r+\mu-\gamma)T(s)} - e^{-(r+\mu-\gamma)R(s)}\right]} \tag{24}$$

Here, the initial wage rate cancels out, such that (24) will hold for T and R independent of time of birth. This implies that agents choose the same length of education and the same retirement age, independent of when they are born. This also implies that all agents in the workforce have the same human capital and thereby the same productivity, such that individual human capital equals average human capital. Denoting these time-independent choices by T and R respectively, (24) and (19) can be written as

$$T = \frac{\alpha}{r + \mu - \gamma} \left(1 - e^{-(r+\mu-\gamma)(R-T)}\right) \tag{25}$$

$$R = \frac{(r + \mu - \gamma)e^{-(g-\gamma)R}}{\epsilon(\mu + \rho) \left[e^{-(r+\mu-\gamma)T} - e^{-(r+\mu-\gamma)R}\right]} \tag{26}$$

jointly determining the equilibrium values for education and retirement, denoted by T* and R* in the following. Here, it is assumed that $g > \gamma$, which is a standard assumption in this class of models.

2.4.1 Equilibrium

In order to examine the equilibrium in more detail, it is convenient to conduct a graphical analysis. As a first step, it is then useful to rewrite (25) and (26) such that one explicit equation for T and one explicit equation for R are obtained. These are given by

$$R = \frac{1}{r + \mu - \gamma} \cdot \left[ln\left(\frac{\alpha}{r + \mu - \gamma}\right) - ln\left(\frac{\alpha}{r + \mu - \gamma} - T\right)\right] + T \tag{27}$$

$$T = -\frac{1}{r + \mu - \gamma} \cdot ln\left(\frac{r + \mu - \gamma}{\epsilon(\mu + \rho)R} \cdot e^{-(g-\gamma)R} + e^{-(r+\mu-\gamma)R}\right) \tag{28}$$

Equation (27) will be denoted the *conditional education equation* in the following, as it was derived from the first-order condition for education, (25). It gives the optimal length of education, conditional on an optimal retirement age. Likewise, equation (28) will be denoted as the *conditional retirement equation* as it was derived from the first-order condition for retirement, (26), and it represents the optimal decision for the retirement age, given an optimal length of education.

Lemma 1. *The conditional education equation, (27), leads to a strictly convex curve giving R as a convex function of T in (T,R)-space. This curve goes through the origin and asymptotically approaches the value* $\tilde{T} \equiv \frac{\alpha}{r+\mu-\gamma}$. *The slope is larger than one at all points.*

Proof. See Appendix A. □

According to Lemma 1, $T^* < \tilde{T}$ will always hold. This is interesting, as $\tilde{T}$ is the optimal education length in the case of no retirement decision. This implies that, given the possibility to retire, agents always choose a shorter period of education.

Lemma 2. *The conditional retirement equation, (28), leads to a curve which is strictly convex, but only slightly so, in T in (T,R)-space. The curve has slope* $\lesseqgtr 1$ *as* $R \lesseqgtr \frac{1}{\mu+\rho}$ *and a positive intercept.*

Proof. See Appendix B. □

Using Lemma 1 and 2, Proposition 1, characterizing the equilibrium, can be established. Denote by c(s,t)* the optimal time path of consumption, chosen by the individual.

Proposition 1. *There exists a unique equilibrium x*=(c(s,t)*,T*,R*), where* $0 < T^* < R^*$.

Proof.

- The equilibrium path of consumption, c(s,t)*, is determined by (21) and (22).
- T* and R* are determined at the intersection of the conditional education curve and the conditional retirement curve. That there can be only one such intersection follows from Lemma 1 and 2.
- $0 < T^* < R^*$ holds. The first inequality is true as the conditional retirement curve was shown to have a positive intercept. The latter inequality is true as the conditional education curve has slope > 1.

□

The unique equilibrium, x*, is illustrated in Figure 2, below.

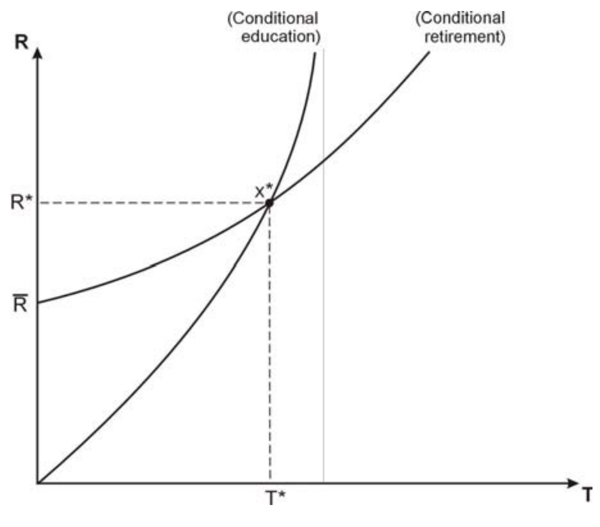


Figure 2: Determination of T* and R*

It should be noted that, although both the conditional education curve as well as the conditional retirement curve can have a slope larger than one in (T,R)-space, they will nevertheless cross, and will do so only once, as the conditional education curve asymptotically approaches the value $\tilde{T}$, whereas the conditional retirement curve is defined over the whole range of T.

The next section discusses how the equilibrium choices T* and R* are affected by changes in life expectancy, both in the sense of increased longevity and an increase in the productive horizon.

3 Analytical Results

This section shows how changes in life expectancy affect the educational as well as the retirement choice. Here, I distinguish between a reduction in mortality and a reduction in morbidity, as in Heijdra and Romp (2009b).[4] A reduction in mortality corresponds to a decrease in the parameter μ. This implies an increase in life expectancy $\frac{1}{\mu}$. As agents are in effect born as adults in the model, here a reduction in the parameter μ can be seen as a reduction in adult mortality and not in child mortality, which is the intended effect in the analysis. Thus, a reduction in mortality models an increase in longevity. In the following this will be denoted as *longevity improvements*.

The second aspect of life expectancy concerns the length of the productive life-span or the physical shape one is in. Here, this can be seen to be determined by the disutility of working. An increase in the span of productive life is thus modeled as a decrease in the disutility of working, ϵ. A decrease in this parameter implies that agents do not find it that tiresome to work. Interpreting this as an improvement in productivity throughout the entire lifetime, a decrease in ϵ can be seen as a reduction in morbidity, meaning an improvement in health conditions. Therefore, a decrease in disutility is denoted as *health improvements* in the following. The graphical analysis of the previous section serves as the basis for this discussion.

3.1 Longevity Improvements

A decrease in mortality will in general cause the present value of wage income, and thereby also the present value of lifetime labour income, to increase as agents feel more secure that they will survive and earn wage income in the future. For the education decision this implies that the investment in human capital becomes more worthwhile, as the return to education increases through the higher wage rate. Note that this is not the same as the Ben-Porath mechanism as we are concerned with the uncertainty about the length of the working life here and not about the length of work life in itself. This decrease in uncertainty would induce an increase in education upon a decrease in mortality and will be termed the *uncertainty effect* in the following.[5]

The Ben-Porath mechanism itself, however, also plays a role. The actual length of the work life will also determine the return to education. Here, the effect is ambiguous. If work life increases this will further increase the return to schooling and thus raise human capital

[4] The terminology and interpretation used here is slightly different, but the distinction is essentially the same.

[5] This terminology is borrowed from Kalemli-Ozcan et al. (2010), where it is used in relation to the retirement decision.

investment. If work life in fact is decreased, this would put a halt on the mechanism and might actually reduce the return to schooling. This effect, concerned with the actual length of the work life will be referred to as the *horizon effect*.

Whether work life increases or decreases then depends on the retirement decision. Here again, there is an uncertainty as well as a horizon effect on the retirement decision as mortality decreases. Firstly, the reduction in uncertainty will cause lifetime labour income to increase, as described above. This means that agents can afford to retire earlier and will thus pull the retirement age down. As noted by Kalemli-Ozcan et al. (2010), a reduction in the uncertainty effect makes it worthwhile to save for retirement and to actually retire. With high uncertainty of surviving through retirement, it would be too risky to save for it. In this case it would be optimal to work until death.

The second effect, the horizon effect on retirement, works in the opposite direction. An increase in life expectancy implies that a longer period of consumption needs to be financed. All else equal, this would induce a later retirement age in order to earn the necessary wage income for the expected increase in consumption.

Whether the schooling period and the retirement age increase or decrease will then depend on whether the uncertainty effects or the horizon effects dominate. Based on the graphical analysis in Figure 2, the effects of a reduction in mortality are as follows.

Lemma 3. *The slope of the curve given by the conditional education equation, (27), decreases at all points upon a decrease in mortality.*

Proof. From (27)

$$\frac{\partial}{\partial \mu}\frac{\partial R}{\partial T} = \frac{T}{(\alpha + (r+\mu-\gamma)T)^2} \quad > 0 \tag{29}$$

holds. Additionally, the intercept was shown to be the origin and is, therefore, not affected. Thus, this curve shifts down when mortality is reduced. □

Lemma 4. *In the conditional retirement equation, (28), a decrease in mortality leads to a higher value of R^* for small T and a lower value of R^* for large T .*

Proof. From (28), the change in T, for given R, is given by

$$\begin{aligned}\frac{\partial T}{\partial \mu} = \frac{1}{(r+\mu-\gamma)^2}\cdot \Bigg[& \frac{(r+\mu-\gamma)\left[\epsilon(\mu+\rho)^2R^2 + (r-\rho-\gamma)e^{(\mu+\rho)R}\right]}{(\mu+\rho)\left[(r+\mu-\gamma)e^{(\mu+\rho)R} + \epsilon(\mu+\rho)R\right]} \\ & + ln\left(e^{-(r+\mu-\gamma)R} + \frac{(r+\mu-\gamma)e^{-(r-\rho-\gamma)R}}{\epsilon(\mu+\rho)R}\right)\Bigg]\end{aligned} \tag{30}$$

□

This would be unambiguously positive if all terms in the above derivative were positive.

The main concern is then whether

$$ln\left(e^{-(r+\mu-\gamma)R}+\frac{(r+\mu-\gamma)e^{-(r-\rho-\gamma)R}}{\epsilon(\mu+\rho)R}\right)\gtreqless 0 \quad\Leftrightarrow\quad k\gtreqless f(R) \tag{31}$$

As described in the appendix, at the intercept $k = f(R)$ will hold, whereas $k < f(R)$ will be true for larger values of R. Thus, the last term in $\frac{\partial T}{\partial \mu}$ is zero at the intercept and negative over the remaining span of R, increasing in absolute value as R increases. This implies that $\frac{\partial T}{\partial \mu}$ will be positive for smaller values of R, close to the intercept, and is then likely to become negative for larger values of R.[6] Thus, the conditional retirement equation will change as in Figures 3 and 4, below. This leads to the following proposition.

Proposition 2. *Upon a decrease in mortality two possible cases can arise.*

- *Case 1: T* and R* increase*
- *Case 2: T* increases and R* decreases*

Proof. Follows from Lemma 3 and 4.[7] □

As longevity increases, it is thus possible that both the schooling period and the retirement age increase (Case 1), but also that schooling is prolonged in combination with earlier retirement (Case 2). This is illustrated in Figures 3 and 4 below.

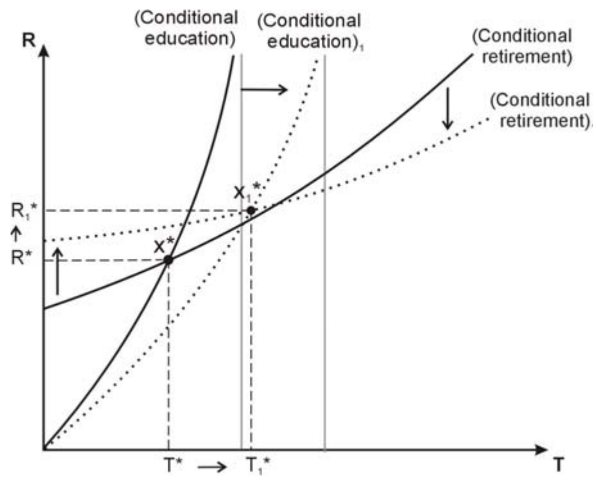


Figure 3: Case 1, effect on T* and R*, decrease in μ

[6]This is confirmed by the fact that the intercept of the conditional retirement equation increases upon a decrease in mortality. See Appendix C for details.

[7]The case of shorter education and early retirement is ruled out due to the fact that the intercept of the conditional retirement equation always increases upon an increase in life expectancy as well as the fact that the slope of the curve is positive at all points.

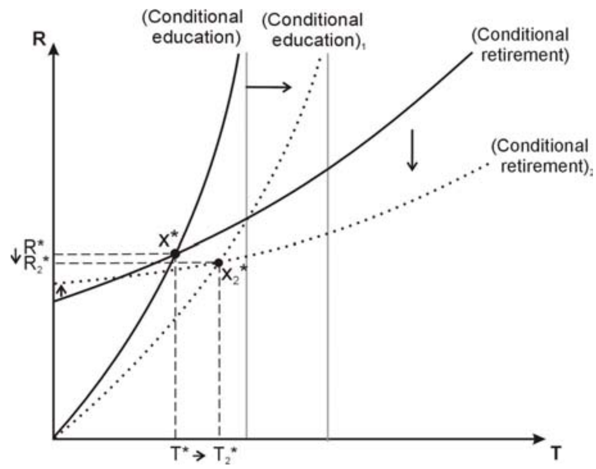


Figure 4: Case 2, effect on T* and R*, decrease in μ

In line with the discussion above, the positive horizon effect on the retirement age dominates the negative uncertainty effect in Case 1, whereas in Case 2 the opposite is true. Here, the uncertainty effect dominates and the retirement age is, thus, reduced. Concerning the education decision, the horizon effect is of ambiguous sign in Case 1. It is not clear whether the increase in the retirement age is proportional or more than proportional to the increase in life expectancy. Educational investment increases, thus either both the uncertainty and the horizon effect are of positive sign or the uncertainty effect dominates. In Case 2 the horizon effect is definitely negative, as the retirement age is reduced. As schooling nevertheless increases, the uncertainty effect must dominate.

Which of the two cases is more likely to arise depends on parameter values, as stated in Proposition 3.

Proposition 3. *Case 2, of earlier retirement, is more likely to arise when*

- *the interest rate, r, is low*
- *the rate of technological progress, γ, is high*
- *the rate of time preference, ρ, is high*

with ρ being the most important determinant for whether Case 2 occurs.

Proof. From Figure 4 it is clear the Case 2 is more likely to arise when the change in the intercept of the conditional retirement equation is relatively small. From the discussion of the intercept of the conditional retirement equation,[8] this will be the case when both the change in k and the change in f(R) are small. As $\frac{\partial k}{\partial \mu} < 0$ and $\frac{\partial f(R)}{\partial \mu} > 0$, this is true when $\frac{\partial}{\partial z}\frac{\partial k}{\partial \mu} > 0$ and $\frac{\partial}{\partial z}\frac{\partial f(R)}{\partial \mu} < 0$, where $z = (r, \gamma, \rho)$. Calculating these derivatives it is found that

[8]See Appendix C.

- $\frac{\partial}{\partial r}\frac{\partial k}{\partial \mu} = -1 \ < 0$ and $\frac{\partial}{\partial r}\frac{\partial f(R)}{\partial \mu} = 0$
- $\frac{\partial}{\partial \gamma}\frac{\partial k}{\partial \mu} = 1 \ > 0$ and $\frac{\partial}{\partial \gamma}\frac{\partial f(R)}{\partial \mu} = 0$
- $\frac{\partial}{\partial \rho}\frac{\partial k}{\partial \mu} = \frac{2r+\mu-\rho-2\gamma}{\epsilon(\mu+\rho)} \ > 0$ [9] and $\frac{\partial}{\partial \rho}\frac{\partial f(R)}{\partial \mu} = -R^3 e^{-(\mu+\rho)R} \ < 0$

such that a relatively low r, high γ or high ρ would lead to a small increase in the intercept and thereby to Case 2. However, it should also be noted that the effect of the interest rate and of γ are not expected to be that strong, as these parameters do not have an effect on the change in f(R). The main driver for early retirement will therefore be the degree of impatience, as measured by ρ. □

These results make intuitive sense as the relevant parameters affect the relative weight of the uncertainty and the horizon effect.

A lower interest rate implies that the lifetime income is discounted less heavily. This means that the present value of lifetime income is rather high. A reduction in the mortality rate, which lightens discounting even further, will then have a relatively strong effect. Additionally, the higher present value of life income implies that the horizon effect is relatively weakened. This stems from the fact that the longer period of consumption is more easily financed with a higher income. Thus, in the presence of a low interest rate, it is easier to afford a longer period of retirement and to pay for the extra periods of consumption. An increase in life expectancy is, then, likely to lead to a reduction in the retirement age as the relatively stronger uncertainty effect dominates the relatively weaker horizon effect.

The same reasoning can be used for understanding the fact that a relatively high rate of technological progress would lead to a decreasing retirement age as life expectancy increases. Note that γ is also the growth rate of the wage earned. Thus with a higher γ, the wage profile will be more upward-sloping. This implies a relatively high wage at all ages. Then the lighter discounting due to a reduction in the mortality rate, the uncertainty effect, will weigh relatively more in the retirement decision. Also again, a high γ will weaken the horizon effect, just as the lower interest rate did, due to the fact that a longer period of consumption can more readily be financed with the higher wage income. With a weaker horizon effect, and a stronger uncertainty effect the latter is more likely to dominate and earlier retirement becomes a possibility as life expectancy increases. However, as noted above, the effects from r and γ are not expected to be very strong.

The most important factor leading to earlier retirement as mortality decreases is the rate of time preference. When ρ is high, utility from consumption is discounted more heavily. Agents are relatively impatient and do not like to postpone consumption. This weakens the horizon effect as consumption in the (now longer) future does not weigh that heavily. The increase in lifetime labour income, induced by the uncertainty effect, will then be used for consumption earlier in life and for earlier retirement. Consumption later in life is relatively less important to the agent and can therefore be lower. Thus, the agent is less willing to

[9] Note that it was assumed earlier that $r + \mu - \gamma > 0$ and $r - \rho - \gamma > 0$. Together this implies that $2r + \mu - \rho - 2\gamma > 0$.

keep on working to finance consumption later in life and is more likely to retire earlier. This explains why Case 2 is more likely to arise when ρ is relatively high.

In principle also the disutility of working will be discounted more heavily, which could be thought to induce a later retirement age. An increase in life expectancy, however, does not have an effect on the relative weight of this disutility of working and does therefore not play a role in the determination of Case 1 or 2.

As noted earlier, education increases in both Case 1 and Case 2. Thus, a negative horizon effect, arising through a reduction in the working life, cannot outweigh the increase in the return to education due to reduced risk of not surviving. Although the Ben-Porath mechanism is not at work in Case 2, human capital investment increases. This shows the importance of taking uncertain lifetime into account. Whereas an increase in the average years lived might not explain the increase in educational attainment that has been seen over the last century, a reduction in the risk of not surviving the recovery period of human capital investment might be able to do so. It is also interesting to see that a reduction in the retirement age could be produced without including a public pension system or any other taxes. Merely the income effect can induce agents to choose a lower retirement age. This is an important consideration in the current public debate on retirement and increasing life-spans.

3.2 Health Improvements

In contrast to a reduction in the mortality rate which concerned the length of the actual or physical life-span, a reduction in morbidity concerns the productivity during the entire life-cycle. It should be interpreted as a general improvement in health condition, and thus an increase in the *productive* time horizon, rather than an increase in the time horizon per se. In the model this corresponds to a reduction in the parameter ϵ.

The same approach as in the previous section can be used to analyze the effects of health improvements on the education and the retirement choice. This leads to Lemma 5 and 6.

Lemma 5. *The conditional education decision is not affected by an increase in health, i.e. a decrease in* ϵ.

Proof. Follows directly from (27). □

Intuitively, this stems from the fact that the disutility of work is linearly increasing in age, beginning from the time of birth. Thus, it was assumed that one derives the same disutility from studying as from working. The reasoning was that it becomes more tiresome to work as one gets older, i.e. it is the age itself that matters for disutility not the type of activity. Everything else equal, a decrease in the disutility parameter does then not have an influence on whether the agent chooses to study or to work.

A different situation arises in the case of retirement. Here, the choice of retirement age has a direct effect on disutility, as agents do not work at all after retiring and, therefore, do not derive any disutility after leaving the workforce. The degree of disutility is, thus, of direct importance in the conditional retirement decision.

Lemma 6. *The conditional retirement curve shifts in upon an increase in health, i.e. a decrease in* ϵ*, in (T,R)-space.*

Proof. From (28) it follows that

$$\frac{\partial T^*}{\partial \epsilon} = \frac{1}{\epsilon \cdot \left[r + \mu - \gamma + \epsilon(\mu + \rho)R \cdot e^{-(\mu+\rho)}\right]} \quad > 0 \tag{32}$$

Thus, T* will be smaller for a given R when ϵ is decreased. □

Proposition 4 can now be established.

Proposition 4. *Improvements in health conditions lead to an increase in the retirement age as well as an increase in the schooling period.*

Proof. Follows from Lemma 5 and 6. □

The above derived results of health improvements are illustrated in Figure 5.

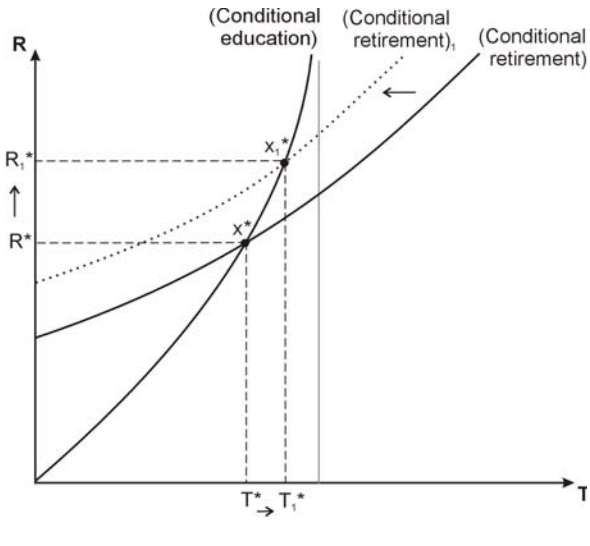


Figure 5: Determination of T* and R*, decrease in ϵ

These results are very intuitive. Improvements in health cause a reduction in the disutility of work which implies that the agent finds it reasonable to work and earn wage income for a longer time. Thus, a later retirement age will be chosen, as indicated by R_1^*. This result is essentially the same as in Heijdra and Romp (2009b). By also taking education into account, however, it is possible to see that the increase in the retirement age will also induce an increase in the schooling period, as indicated by T_1^*.

This is important to note for two reasons. On the one hand, it might entail that the length of the working life does not actually increase although the agent chooses to work longer. This will be the case if the postponement of retirement is entirely or possibly even more than offset by a longer educational period. On the other hand, health improvements will exhibit a reinforcing effect on productivity. Interpreting a reduction in disutility of working as an improvement in general health, this will in itself, and by definition, increase the productivity of the workforce. As agents will be able to work longer, it becomes more profitable to invest into education. This, in turn, will further enhance the productivity of the labour force as longer education will increase human capital in the economy. Thereby, the exogenous increase in productivity will be reinforcing by an endogenous inducement of higher human capital investment.

4 Numerical Results

In the theoretical model agents are born as adults. In the numerical simulations below, this is interpreted as an initial age of 16. This seems a reasonable age where agents are able to take their own decisions on educational choice. This goes in hand with the fact that compulsory schooling ends around this age in most western countries. Life expectancies reported in the figures are equal to $\frac{1}{\mu}$ and should thus be interpreted as life expectancy as seen from age 16. The chosen parameter values for the benchmark case are reported in Table 1 below. In general, the simulation results should be seen as pertaining to different countries with different sets of parameter values, as they are not concerned with transitionary dynamics.

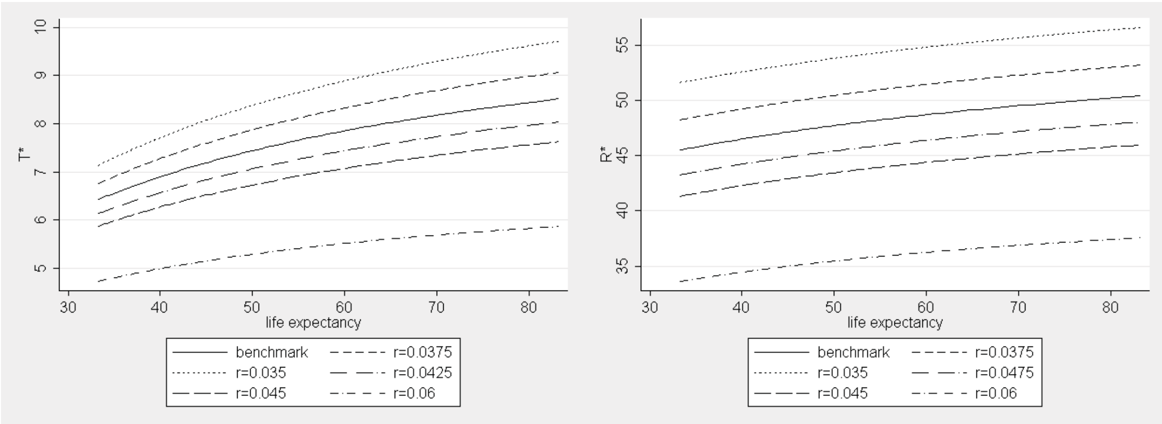
r	0.04
γ	0.015
ρ	0.02
ε	0.031
α	0.4

Table 1: Parameter values, benchmark case

The value of the interest rate is based on Heijdra and Romp (2008). The rate of technological progress is chosen to be slightly higher than in Gertler (1999), in accordance with OECD estimates of labour productivity growth over the past ten years (OECD.Stat).[10] The rate of time preference is set to a value lying between Heijdra and Romp (2008) and Heijdra and Romp (2009b), where ρ is set to 0.0159 and 0.039 respectively. The value of ϵ is calibrated such that the retirement age equals 65 at a life expectancy of 80 years in the benchmark case. The parameter value for α is based on estimates in Ciccone and Hall (1996).

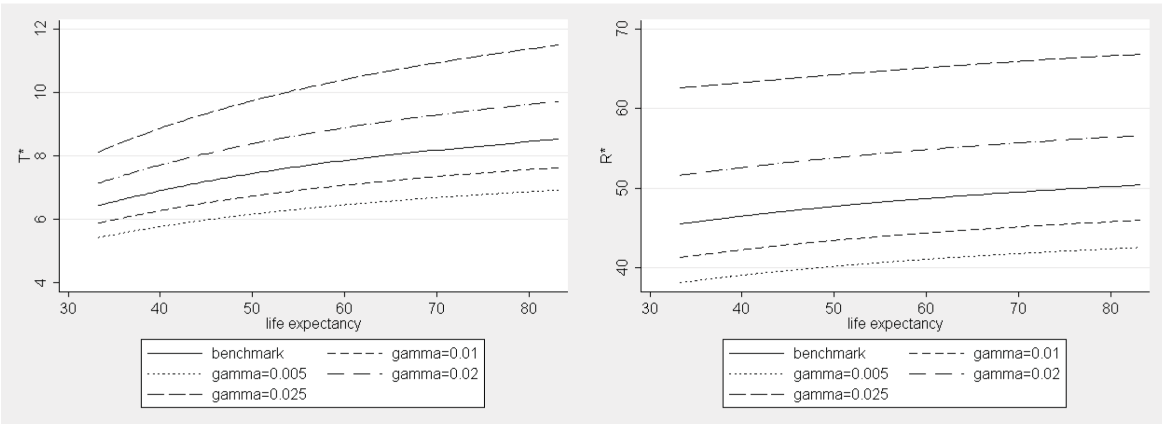
[10] See Appendix D for data sources.

The following figures show how the optimal values for educational length and the retirement age vary with varying parameter values. The benchmark case is included in every figure as a reference.



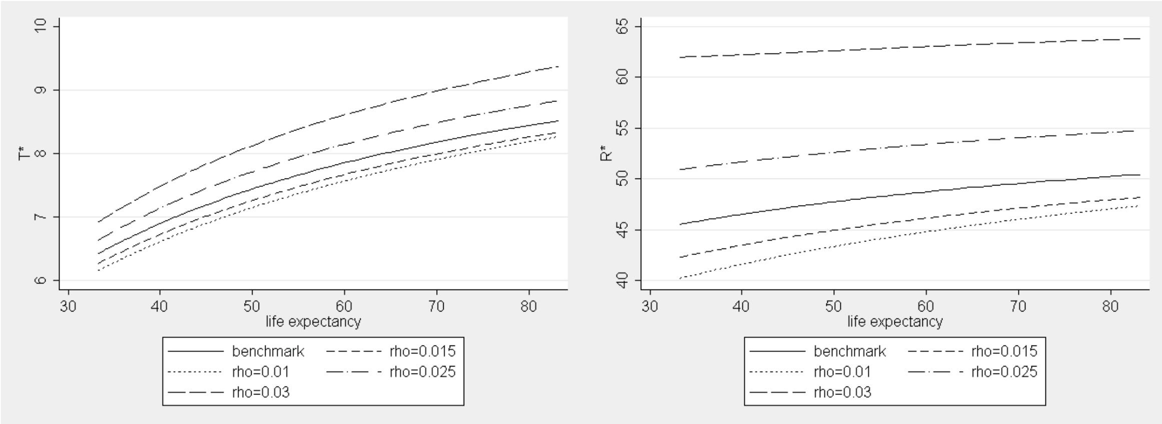
(a) effect on T* (b) effect on R*

Figure 6: Change in r



(a) effect on T* (b) effect on R*

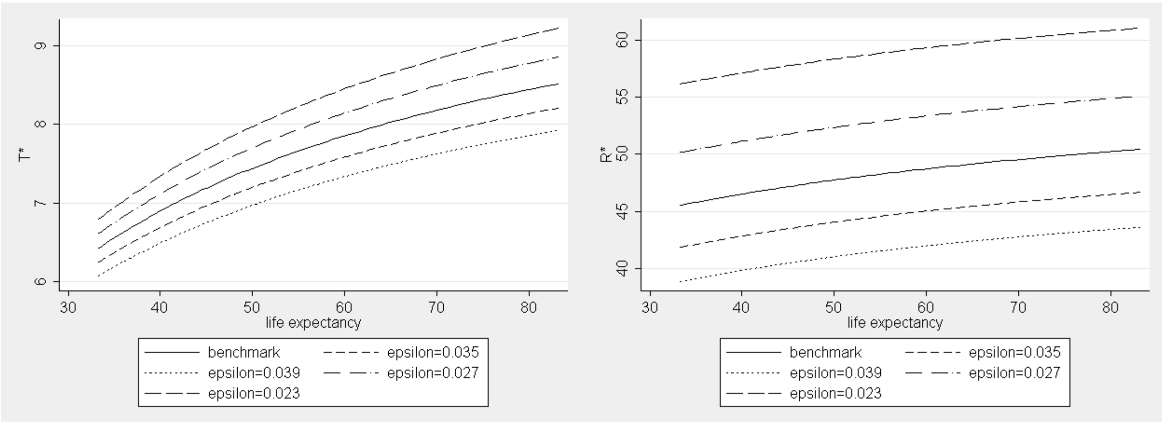
Figure 7: Change in γ



(a) effect on T*

(b) effect on R*

Figure 8: Change in ρ



(a) effect on T*

(b) effect on R*

Figure 9: Change in ϵ

Figures 6 and 7 confirm that the effects of the interest rate and of the technological growth rate on early retirement are not that strong. This can be seen from the fact that the slope of R* does not seem to change when r is relatively low or when γ is relatively high. The results also show that a higher interest rate in general will lead to a lower retirement age. This can be explained by the fact that a higher r implies a higher growth rate of consumption. Thus, the individual consumption profile is rather upward sloping and consumption will be quite high at older ages. This in turn means that the marginal utility derived from an extra unit of consumption is relatively low. This induces agents to stop working earlier, as the utility derived from working longer is rather low.

Also a relatively low rate of technological progress can be seen to induce a lower level of the retirement age. A low level of γ implies a relatively low wage at older ages. Thus, working does not pay off that much and an earlier retirement age is chosen.

Figure 8 shows that a higher ρ is more likely to lead to earlier retirement, as described in Section 4.1. However, also for a rate of time preference of 3%, the slope is still positive. Thus, Case 2 does not seem too likely to arise. Moreover, it can be seen that a higher ρ will in general imply a higher retirement age as a higher ρ implies a lower growth rate of consumption. The reasoning here is analogue to the one for the interest rate. Given a rather low growth rate of consumption, the marginal utility of an extra unit of consumption will be relatively high. This induces the agent to continue working, i.e. to choose a higher retirement age. The fact that a higher ρ also means that disutility from working is discounted more heavily works in the same direction, as agents do not find it that tiresome to work at older ages and therefore postpone retirement. The higher retirement age then imposes a general equilibrium effect on the schooling decision, as the rate of time preference in itself does not effect the length of schooling. Later retirement prolonges the recovery horizon of human capital investment and, thus, leads to longer schooling as evident from figure 8.

The results for a change in ϵ, as shown in figure 9, are also as expected. A lower ϵ induces both a longer schooling period and later retirement. In addition, both profiles can be seen to be upward sloping as life expectancy increases.

The above also shows that the distinction between length of life and length of working life is not that important in early stages of development, i.e. at low values of life expectancy. Here, agents choose to work until they die, in that $R^* > \frac{1}{\mu}$. Soon, however, it is optimal to retire, highlighting the importance of the correct definition of the recovery horizon of human capital investment when using the Ben-Porath mechanism.

In general, the numerical examples above indicate a rather strong positive effect on schooling. If the mortality rate was increasing in age and mortality reductions would take place especially at older ages, this effect would be smaller. This is due to the fact that the uncertainty effect would be weaker in this case.

The effect on the length of work life in these numerical examples is summarized in figure 10, below. Here the benchmark case is included, as well as the two most 'extreme' scenarios from the parameter changes above.

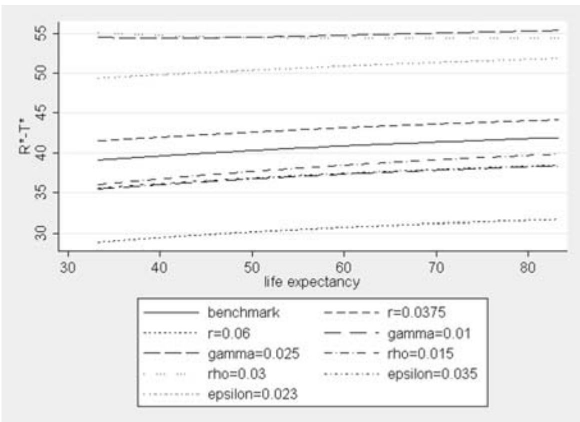


Figure 10: Effect on length of worklife

It appears that in general the effect on the length of work life is, in fact, positive. This is opposed to previous work, e.g. Boucekkine et al. (2002), who find that the retirement age increases proportionally with schooling, leaving the length of the work life unchanged. With a positive effect on the length of work life, however, the growth effect of an increase in life expectancy would be positive as the workforce would both be more productive and larger. In the case of a high rate of time preference, ρ, however the effect on the length of work life is actually negative. Thus, although both schooling and the retirement age increased in this case, the retirement age increased less than proportionally. In this case the growth effect is potentially negative, as the increase in the productivity of the workforce might be more than offset by a smaller size of the workforce.

5 Conclusion

This paper has shown three major points. Firstly, an increase in life expectancy, as reflected by a decrease in mortality, does not necessarily imply an increase in work life. Thus, the recovery horizon of human capital investment does not necessarily increase upon an increase in life expectancy. Not only is it unclear whether the retirement age increases proportionally with an increase in schooling, but even early retirement can arise under certain circumstances, especially when agents are very impatient. Secondly, it was shown that educational attainment nevertheless increases upon a decrease in mortality. This is however not due to the increase in the actual length of the investment recovery period but due to a reduction in survival uncertainty. Thus, even if the Ben-Porath mechanism is not at work, reduced risk of mortality induces higher investment in human capital. As long as the *expected* length of work life increases, will also schooling increase. It is therefore important to take the uncertainty about life-spans into account. These two points reconcile the empirical finding of Hazan (2009) of falling lifetime labour supply with increasing educational attainment.

Additionally, it was found that a reduction in morbidity would have a reinforcing effect on the productivity of the workforce. Not only would a healthier workforce be more productive in itself, this also makes it more worthwhile to invest in schooling, thereby increasing productivity even further.

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Appendix

A Proof of Lemma 1

- $T < \frac{\alpha}{r+\mu-\gamma}$ will always hold as $ln\left(\frac{\alpha}{r+\mu-\gamma} - T\right)$ in (27) would otherwise not be defined
- That the slope of (27) is positive and larger than one in (T,R)-space can be seen from

$$\frac{\partial R}{\partial T} = 1 + \frac{1}{(r+\mu-\gamma)(\frac{\alpha}{r+\mu-\gamma} - T)} \quad > 0, \ > 1 \tag{A.1}$$

- (27) is a convex function in T, as seen from differentiating (A.1) once more w.r.t. T

$$\frac{\partial^2 R}{(\partial T)^2} = \frac{1}{(r+\mu-\gamma)\left(\frac{\alpha}{(r+\mu-\gamma)} - T\right)^2} \quad > 0 \tag{A.2}$$

- (27) goes through the origin. Setting T to zero in the conditional education equation gives R=0.

B Proof of Lemma 2

- First it should be noted that

$$\begin{gathered} \frac{r+\mu-\gamma}{\epsilon(\mu+\rho)} e^{-(g-\gamma)R} + e^{-(r+\mu-\gamma)R} \ \leq \ 1 \\ \Leftrightarrow \\ \underbrace{\frac{r+\mu-\gamma}{\epsilon(\mu+\rho)R}}_{\equiv k} \ \leq \ \underbrace{(1-e^{-(r+\mu-\gamma)R})Re^{(g-\gamma)R}}_{\equiv f(R)} \end{gathered} \tag{B.1}$$

  is required to ensure a positive value of T. That this indeed will be the case, remains to be shown.

- The slope of (28) is positive in (R,T)-space and thereby also positive in (T,R)-space. This can be seen from the fact that differentiating (28) with respect to T gives

$$\frac{\partial T}{\partial R} = \frac{\epsilon(\mu+\rho)R^2 + e^{(\mu+\rho)R}(1+(g-\gamma)R)}{\epsilon(\mu+\rho)R^2 + e^{(\mu+\rho)R}(r+\mu-\gamma)R} \quad > 0 \tag{B.2}$$

  which is positive. In addition, it can be noted that this slope will be > 1 in (R,T)-space (and thus < 1 in (T,R)-space) for $R < \frac{1}{\mu+\rho}$. For a value of $R > \frac{1}{\mu+\rho}$ the slope will be < 1 in (R,T)-space (i.e. > 1 in (T,R)-space).

- The above already indicates that the conditional retirement equation is a concave function in (R,T)-space. This is confirmed by the second derivative

$$\frac{\partial^2 T}{(\partial R)^2} = \\ -\frac{e^{2(\mu+\rho)R}(r+\mu-\gamma)+\epsilon e^{(\mu+\rho)R}(\mu+\rho)\left[2-2(\mu+\rho)R+(\mu+\rho)^2R^2\right]}{R^2\left[e^{(\mu+\rho)R}(r+\mu-\gamma)+\epsilon(\mu+\rho)R\right]^2} \tag{B.3}$$

being negative for $R > \frac{1}{\mu+\rho}$ as well as $R > \frac{2}{\mu+\rho}$. In between these values the function might be convex, however this would not matter for the results. Additionally, the derivative was found to be negative and close to zero by numerical examples. Slight concavity in (R,T)-space implies slight convexity in (T,R)-space.

- The conditional retirement decision has a positive intercept in (T,R)-space. This can be seen from the fact that T=0 can only be a solution to (28) when

$$\frac{r+\mu-\gamma}{\epsilon(\mu+\rho)} = (1-e^{-(r+\mu-\gamma)R})Re^{(g-\gamma)R} \\ \Leftrightarrow \\ k = f(R) \tag{B.4}$$

f(R) will equal the positive value k for a positive value of R, since f(R) is an increasing function in R, as seen from

$$\frac{\partial f(R)}{\partial R} = (r+\mu-\gamma)R\cdot e^{-(\mu+\rho)R}+(1-e^{-(r+\mu-\gamma)R})(1+(r-\rho-\gamma)R)e^{(r-\rho-\gamma)R} \;\; > 0 \tag{B.5}$$

Furthermore, the second derivative of f(R) w.r.t. R is given by

$$\frac{\partial^2 f(R)}{(\partial R)^2} = e^{-(\mu+\rho)R}(2(\mu+\rho)-(\mu+\rho)^2R)+(r-\rho-\gamma)(2+(r-\rho-\gamma)R) \tag{B.6}$$

which is $\gtreqless 0$ for $R \lesseqgtr \frac{2}{\mu+\rho}$. Thus, f(R) will be convex for $R < \frac{2}{\mu+\rho}$ and concave for $R > \frac{2}{\mu+\rho}$. Hence, the shape of f(R) in Figure B.1, which illustrates the determination of the intercept.

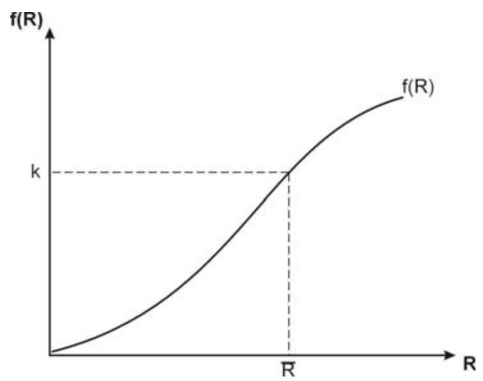

Figure B.1: determination of the intercept, $\bar{R}$

The intercept, denoted $\bar{R}$ in the following, is determined where f(R)=k. This shows that the intercept of the conditional retirement equation will always be positive.

- The previous point also shows that the condition for a non-negative value of education mentioned above, $k \leq f(R)$ will always hold. At the intercept we have $k = f(R)$. Then, since f(R) is an increasing function in R and k is constant with respect to R, $k \leq f(R)$ is fulfilled over the remaining span of the conditional retirement equation.

C Change in the intercept of (28)

As described earlier, the intercept of the conditional retirement equation is determined by the function f(R) and the value k. Both of these are dependent on the mortality rate, μ, according to

$$\frac{\partial f(R)}{\partial \mu} = e^{-(\mu+\rho)R} R^2 \quad > 0 \tag{C.1}$$

$$\frac{\partial k}{\partial \mu} = -\frac{\epsilon(r-\rho-\gamma)}{(\epsilon(\mu+\rho))^2} \quad < 0 \tag{C.2}$$

This implies that f(R) shifts down and k increases upon a decrease in μ. Thereby, the intercept increases from $\bar{R}$ to $\bar{R}_1$, as illustrated in Figure C.1 below. Here, μ is decreased by one unit in both $f_1(R)$ and k_1.

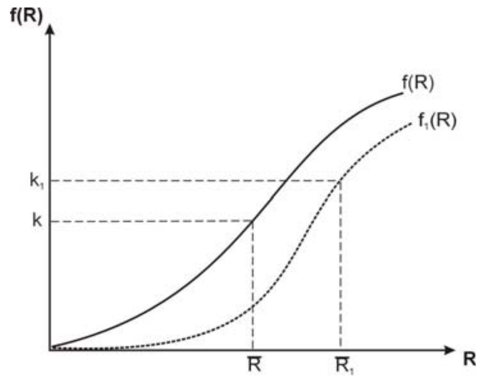

Figure C.1: change in intercept of conditional retirement, decrease in μ

D Data Appendix

Labour productivity growth: 'Labour productivity annual growth rate'. OECD.Stat, productivity, labour productivity growth.

Chapter 2

Survival of the richest? Social status, fertility and social mobility in England 1541-1824

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Survival of the richest? Social status, fertility and social mobility in England 1541-1824

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We use data collected by the Cambridge Group to investigate and explain differences in fertility by socio-economic group in pre-industrial England. We find, in line with results presented by Greg Clark, that wealthier groups did indeed have higher fertility until the 1700s. We demonstrate that this had to do with earlier age at marriage for women. We then turn to the likely social and economic impact of this, considering Clark's hypothesis that 'middle-class values' spread through English society prior to the Industrial Revolution. Through the construction of social mobility tables, we demonstrate that the children of the rich were indeed spreading through society, but they were small in number relative to poorer sections of society, and moreover the children of the poor were also entering the middle classes.

1. Introduction

This article looks at the role of socio-economic status as a determinant of fertility and social mobility in pre-industrial England. We do this using demographic data compiled by the Cambridge Group and documented by Wrigley *et al.* (1997). The data cover 26 parishes scattered across England in a way that was intended to make them representative of the entire country. In addition to information on the number of children being born to each family, the data also sometimes record the occupations of parents and their offspring, which we use to describe the socio-economic status of individuals, as well as intergenerational social mobility within families.

We find that the Cambridge data support the findings of Clark and Hamilton (2006) and Clark (2007), who look at the relationship between wealth and fertility as implied by information recorded in wills, namely that individuals from wealthier social groups were more successful in terms of reproduction. We also investigate the mechanisms by which the poorer groups in society limited their fertility, finding that this was achieved primarily by women delaying marriage.

Clark suggests that a fertility gap between the rich and the poor could have had important implications for the spread of 'middle-class values' through English society prior to the Industrial Revolution via downward social mobility. He describes the middle class as being 'patient, less violent, harder working, more literate, more thoughtful' (Clark 2007, pp. 183–4). Clearly, due to the nature of most of these terms we cannot test directly if 'middle-class values' really did come to dominate in society. Nevertheless, he states that these values spread by virtue of the fact that the structure of society was rather stable, which meant there was not enough room at the top for the children of the rich, who thereby were forced to move into other classes.

This twin prediction, that the rich had more children and that society was socially static, is indeed a testable hypothesis. Yet, while Clark's postulates have been subject to a hefty debate, particularly in the present journal (Clark 2008; Grantham 2008; McCloskey 2008; Persson 2008; Voth 2008), very few attempts have been made to visit the relevant evidence in order to confirm or refute his propositions. Clark himself seems rather agnostic on the actual mechanisms spreading these values. If this was indeed happening then it raises a number of crucial questions: was the spread of middle-class values due to a Lamarckian process of cultural transmission or one of genetic survival, which seems to be gaining ground as an explanation within Unified Growth Theory (Galor and Moav 2002; Galor 2005)? We also seek to shed light on this question.

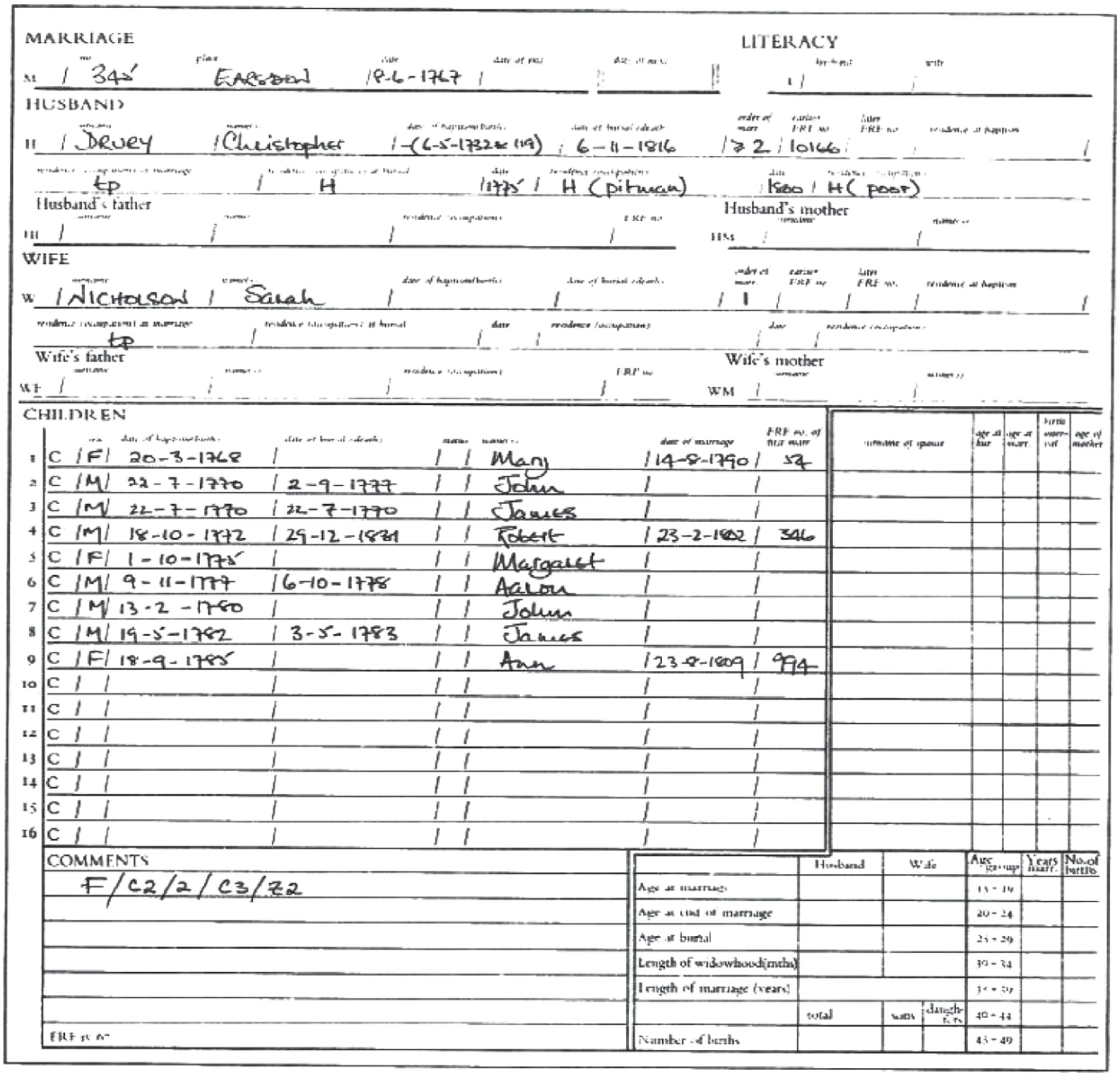
2. The data

2.1. *Description of the data*

Building on statistics collected from Anglican parish registers over the past forty years by the Cambridge Group, the family reconstitution data, documented by Wrigley *et al.* (1997), provide an extraordinary opportunity for testing the hypothesis of the survival of the richest, as well as investigating social mobility in England as a whole. The data cover an extensive period, 1541–1871, although the exact size of the samples we make use of below depends on the variables we look at.

The data are based on so-called *family reconstitution forms* (*FRF*s), each of which builds on a marriage (with a unique FRF number). Table 1 offers an example of a family reconstitution form. While the handwritten text may be difficult to read, a *complete* marriage form (not all information is always reported) includes the dates of birth and death (or baptism/burial) of the spouses, their marriage date, their number of offspring and the offspring's birth and death dates and, finally, the spouses' occupations at marriage and at death. Importantly, if the couple's offspring themselves went on to marry (as is the case for children 1, 3 and 9 in Table 1 below), then the family reconstitution form will link us to the marriage, and hence a family reconstitution form for the offspring. That way we are able to

Table 1. *Family reconstitution form*



MARRIAGE

M / 345 EARSDON 18-6-1767 /

LITERACY

HUSBAND

H / DRUEY / Christopher / -(6-5-1732e (19)) / 6-11-1816 / 2 / 10166

tp / H / 1775 / H (pitman) / 1800 / H (poor)

Husband's father

HF / / / /

Husband's mother

HM / /

WIFE

W / NICHOLSON / Sarah / / / 1 / / / /

tp / / /

Wife's father

WF / / / /

Wife's mother

WM / /

CHILDREN

		sex	date of baptism/birth	date of burial/death		names	date of marriage	FRF no. of first marr
1	C	F	20-3-1768			Mary	14-8-1790	57
2	C	M	22-7-1770	2-9-1777		John		
3	C	M	22-7-1770	22-7-1770		James		
4	C	M	18-10-1772	29-12-1831		Robert	23-2-1802	346
5	C	F	1-10-1775			Margaret		
6	C	M	9-11-1777	6-10-1778		Aaron		
7	C	M	13-2-1780			John		
8	C	M	19-5-1782	3-5-1783		James		
9	C	F	18-9-1785			Ann	23-8-1809	994
10	C							
11	C							
12	C							
13	C							
14	C							
15	C							
16	C							

COMMENTS

F/C2/2/C3/Z2

	Husband	Wife	Age group	Years marr.	No. of births
Age at marriage			15–19		
Age at end of marriage			20–24		
Age at burial			25–29		
Length of widowhood (mths)			30–34		
Length of marriage (years)			35–39		
	total / sons / daughters		40–44		
Number of births			45–49		

draw a connection between the occupational status of the parents and their offspring.

The Cambridge data offer three main advantages compared to the data on which Clark *et al.* draw their conclusions. Firstly, they include a wide range of the population, while Clark's data tend to cover just the wealthier, i.e. those who left a will. Secondly, while Clark's data cover only a fraction of England, mainly East Anglia but also London, Bristol and Darlington, the Cambridge data cover a much larger geographical area, comprising 26 parishes scattered across England in a way that makes them representative of the entire country.[1]

[1] In three of these 26 reconstitution parishes no occupations were recorded, namely Earsdon, Hartland and Methley. These are located in different parts of England, however, so presumably this does not impact too badly on the representativeness of the data.

Last but not least, the Cambridge data offer much richer demographic information than the Clark data, concerning both the reproductive success of families and social mobility across generations within families. For example, 'surviving offspring' in the Clark–Hamilton study are the number of children included in the will (Clark and Hamilton 2006). This is regardless of the offspring's age at the time of death of the testator, which of course is not specified in the will (indeed, an heir may be just one or two years old). In addition to that, there is a risk that children were excluded from the will. The Cambridge data, on the other hand, allow a calculation, not only of the number of children born to a family (as registered in the church books), but also the number of these children who *survived* their childhood, i.e. remained alive at least until age 15.

There are also several weaknesses in the Cambridge data set compared to that of Clark and co-authors. A major problem for us with the Cambridge records is that they include no direct information on the wealth of families, whereas Clark and Hamilton (2006), Clark (2007), Clark and Cummins (2009, 2010) all use wealth as the predictor of net fertility. However, the fact that the Cambridge data record parental occupation enables us to make a comparison of reproductive success based on occupational status. Moreover, since the will data occasionally report the occupation of heirs, we can make some headway beyond the Clark–Hamilton study by analysing social mobility across generations within families.

Another drawback of the Cambridge data set is the data missing due to migration out of the parishes scrutinized by the Cambridge Group (Souden 1984). We will bias our estimates of fertility downwards if we do not take account of the fact that fathers might move out of the parish during their lifetime, thus leaving us with an incomplete record of their offspring. We take account of this by only looking at fathers for whom we know the death dates, thus making it very likely that they stayed in the same parish after getting married.

Finally, it is worth mentioning that, while the Cambridge data are mostly rural in character, the data of Clark *et al.* also include men from urban areas. This means that our data become less representative as England urbanized – a point we will return to later. However, our data also come from larger market towns such as Gainsborough and Banbury, and, in general, the reconstitution parishes are larger than average, with an average of 2,187 inhabitants as opposed to 860 inhabitants for all parishes in England in 1801 (Wrigley *et al.* 1997).

2.2. Availability and classification of occupations

Since males at the time were far more often in the labour market than females, the occupations of women are very often missing in the data, so we focus exclusively on the occupational link in the data between fathers and sons. When available, we use the occupation at marriage for both sons and fathers. Often, we only have occupation at death available and we use this information instead. A possible concern is that occupations are only recorded for a biased subsample of the population. In an attempt to check this, we have compared fertility in each year for the whole sample with that for our subsample, and the numbers are virtually identical.

In the period up to 1825[2] the sample includes observations for a total of 89,887 fathers. Occupation is known for 15,159 of these, but since we also require that fathers have their death dates reported (so as to avoid the possibility that they left the parish before completing their reproductive activities), this leaves us with 9,925 fathers. Among these, 2,778 have reported occupation at the time of marriage; 8,309, occupation at the time of death; and 1,162, occupation at the time of death as well as at marriage. By regressing social class at the time of marriage on social class at the time of death, we cannot reject the hypothesis that the point estimate between the two social classes is one (the estimate is 0.982 with a standard error of 0.0101). That, in turn, means that that social class at death is a good proxy for social class at marriage, and vice versa. This subsample of 9,925 fathers is used for the analysis of fertility. For the results on social mobility, however, we also need to know the son's occupation. Here we have information on 1,396 sons and their fathers, in the period up to 1750.[3] The frequency of the data is displayed in Figure 2, where the year applied is the marriage year of the couple or, if not available, the birth year of the first child in the left panel and the birth year of the son in the right panel.[4]

As previously noted, Clark's hypothesis rests on information concerning the wealth of individuals, which is unavailable in the Cambridge data set. We have, however, since Greg Clark kindly made the precise details of his classifications available to us, been able to map our occupations into the same seven social groups based on wealth as described in Clark and Cummins (2010); see Table 2. A detailed breakdown of the composition of these groups is given in the appendix.

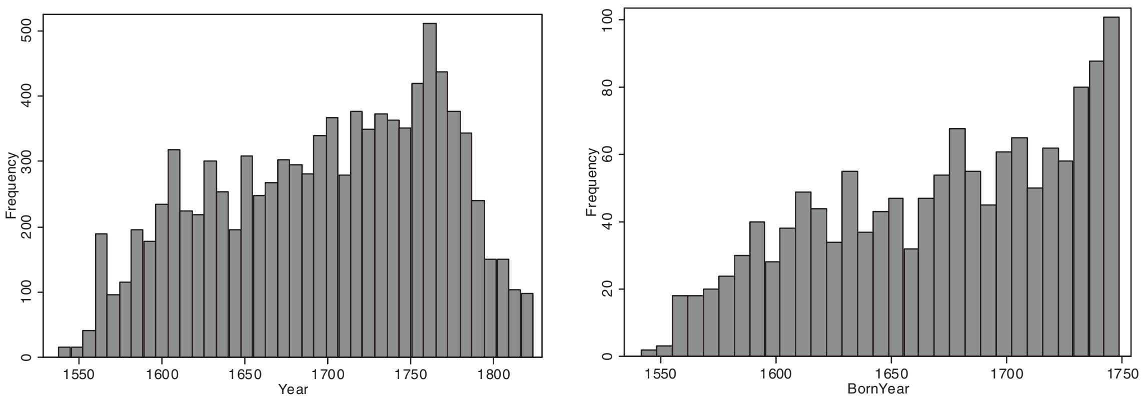
As described above, Clark characterizes the middle class in terms of values and wealth. The social groups are classified by wealth in ascending order. As to the values, the only variable we can observe is literacy. We measure the percentage of fathers who are literate, where an individual will count

[2] We do not use observations later than 1824 as it becomes more likely to observe only fathers with a relatively low life span towards the end of the period, which would imply unrepresentatively low fertility.

[3] The use of this shorter period will be explained in more detail in Section 3.1.

[4] We use the marriage year or the birth year of the first child to classify families into 25- or 50-year periods for the results on fertility. For the mobility results the birth year of the particular son is applied, since all sons with available occupational information in a family are used here.

Figure 1. *The 26 parishes from the Cambridge Group's family reconstitution*



Observations on father's occupation

Observations on father's and son's occupation

Figure 2. *Data frequency*

as literate if the marriage form was signed with the name instead of a mark.

Looking at the literacy rate by group in Table 3 reveals that the higher classes do indeed have a higher percentage of literate men, a pattern which is particularly clear when comparing the highest groups to the lowest. Partly with this is mind, we choose to focus on the differences between groups 6 and 7 and groups 1 and 2 for the remainder of this article.

Table 2. *Social groups according to Clark and Cummins (2010)*

Social groups	
7	Gentry/Independent
6	Merchants/Professionals
5	Farmers
4	Traders
3	Craftsmen
2	Husbandmen
1	Labourers/Servants

Table 3. *Literacy rate by group*

Social group	pre-1725	1725–74	1775–1824	Total	N
7	1.00	0.91	1.00	0.96	53
6	0.67	0.76	0.84	0.79	153
5	0.45	0.83	0.89	0.84	113
4	0.67	0.95	0.90	0.91	112
3	0.67	0.87	0.82	0.83	298
2	0.31	0.66	0.56	0.59	185
1	0.50	0.29	0.29	0.30	376
Total	0.57	0.68	0.62	0.64	
N	72	546	672		1,290

3. Survival of the richest?

This section uses the Cambridge data to reinvestigate the hypothesis advanced by Clark that wealthier families displayed higher fertility at a time when society was structurally static, and to examine the factors behind any differences in fertility between classes using information on age at marriage, length of reproductive period and spacing between the births of offspring.

3.1. Did wealthier fathers leave more children?

As discussed in the introduction, Clark argues that 'middle-class' families had persistently higher reproductive success before the Industrial Revolution than their lower-social-class counterparts (Clark 2007). This is a relatively simple matter to investigate using the Cambridge data, and we do indeed find support for this hypothesis when looking at fertility levels for the different social classes, as Figure 3 illustrates.[5] For illustrative purposes, we have grouped the classes into four, and we have divided the sample into 25-year periods, within which we calculate the average number of children born to

[5] Here we look at the number of children born to a father. Thus, if a man was married more than once all his children are included.

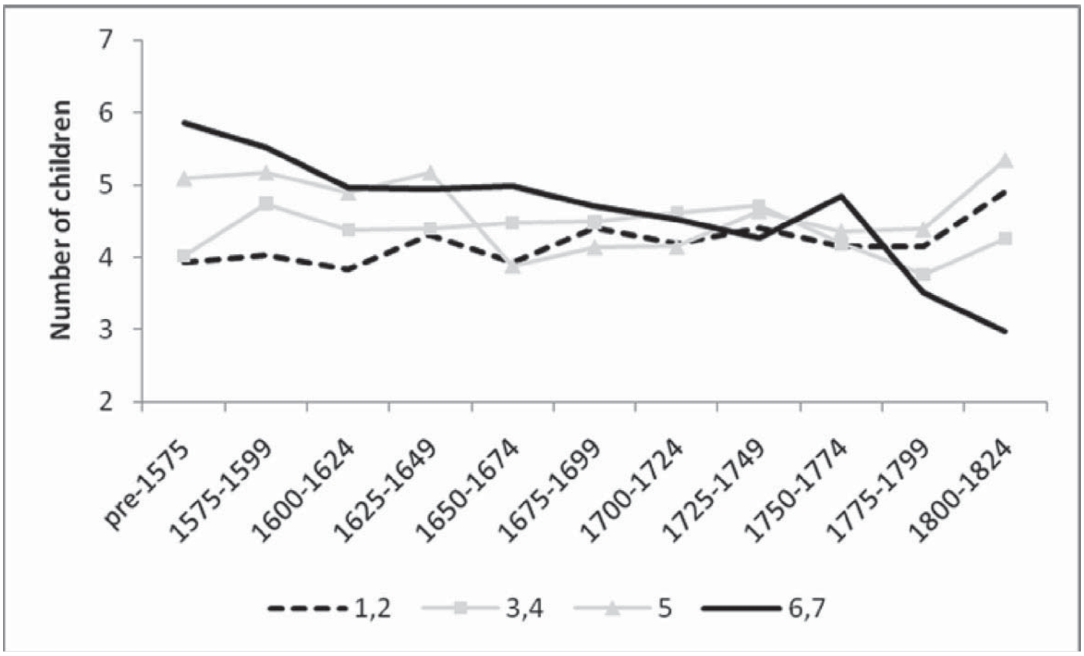


Figure 3. *Fertility by social group*

fathers who got married or had their first child within each particular 25-year period. The same periods are also used for the remaining results in this section.

Figure 3 shows that the wealthiest families, i.e. those in groups 6 and 7, gave birth to roughly one more child than their class 1 and 2 counterparts, especially at the beginning of the period, with groups 3 and 4 lying in between. Group 5, which is predominantly 'farmers', seems to follow a pattern more akin to the wealthier groups at the start of the period, and more like the poorer groups towards the end, which probably reflects the changing status of the word 'farmer' over this period.[6]

What ultimately counts for the hypothesis of value spreading, however, as was stressed by Clark and Hamilton (2006) and by Clark (2007), is not the number of children born to a family (gross fertility), but the number of *surviving* children, i.e. offspring who reach 15 years of age. Offspring who have no death date reported are counted as surviving offspring, following Wrigley *et al.* (1997). This builds on the implicit assumption that children remain with their parents (who we know stayed in the parish) up until the age of 15. Figure 4 shows the number of children surviving by social class. Remarkably, Figure 4 is virtually identical to Figure 3,[7] with the

[6] We are grateful to Leigh Shaw-Taylor for pointing this out to us.

[7] This is a strong argument against the widespread hypothesis that families have a fixed target number of surviving children, and that a decline in mortality was responsible for the fall in fertility associated with the demographic transition. Instead, the present findings suggest a conscious fall in the target size of the family, possibly in response to increasing costs of raising children.

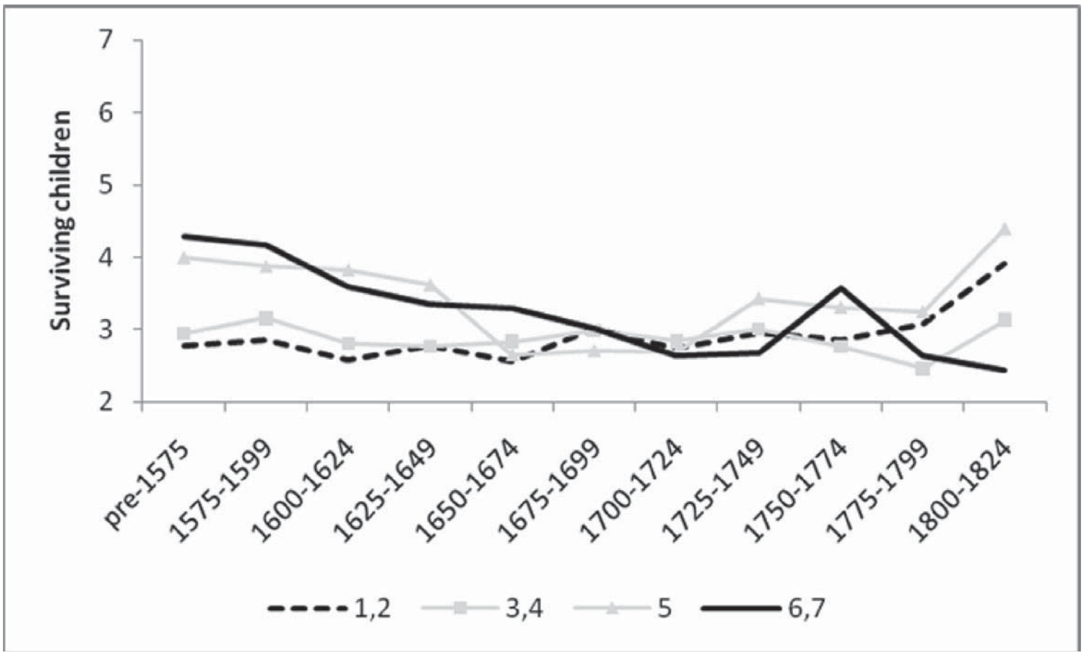


Figure 4. *Reproductive success by social group*

wealthier families producing roughly one more surviving offspring than the poorest groups, where this difference is most prominent in the sixteenth and seventeenth centuries. Clark and Cummins (2010), using a larger data set on testators, reach a similar conclusion, that wealthier testators were more successful in terms of reproduction until around 1780.

Interestingly, Figure 3 also reveals that the decline in the number of children born – one of the main components of the historical demographic transition – started much earlier among wealthier families than among the lower social classes. This led to a point where, by the nineteenth century, they were generally having *fewer* children than poorer groups in society, a finding supported by Clark and Cummins (2009, 2010). A similar story, including the same spike in fertility at the end of the eighteenth century, has been documented for the British and Irish Quakers, a group that was certainly better off than average (Vann and Eversley 1992, pp. 132, 173).

It is also striking that the onset of the fall in fertility among middle-class families coincides with that of French families (Weir 1994), where it also seems to have been the richest groups who reduced fertility first (Cummins 2009). The early fertility decline in France has been a great puzzle to scholars of demography, since it is difficult to explain why the fertility of the French declined before the fall in mortality. The Cambridge data point to the fact that England, at least among non-manual families, saw a pattern that was similar to that of the French.

In order to test more formally whether the differences in reproductive success are statistically significant we conduct a regression analysis, regressing the number of surviving children on the social group of the father.

Table 4. *Regressing net fertility on social group for the period until 1750*

Dependent var.: surviving sibship size Period: pre-1750		
	Coef.	Std. error
Group 7	0.166***	0.048
Group 6	0.208***	0.035
Group 5	0.164***	0.040
Group 4	0.136***	0.035
Group 3	0.093***	0.029
Group 2	0.105***	0.029
Constant	0.944***	0.083
Parish controls	yes	
N	7,047	
Pseudo R^2	0.007	

*** significant at 1%

The results are presented in Table 4. Since the relationship between wealth and fertility seems to change sometime in the eighteenth century, we limit our sample to the period before 1750. We control for differences owing to parish-level differences in net fertility by including parish dummies[8] and the results are found using a negative binomial regression, to take account of the discrete nature of the dependent variable.

Clearly, all social groups have significantly more children than group 1, which is the reference category. It is also clear that there is no significant difference between the parameter estimates for groups 6 and 7 – justification for our aggregation of these groups in the figures above. To interpret the coefficients it is necessary to take the exponential function to the constant, in the case of group 1, or the constant plus the coefficient, in the case of the other six groups. So, for example, the expected number of children for a person in group 1 is $e^{0.944} = 2.57$, whilst for someone in group 6 it is $e^{(0.944+0.208)} = 3.17$.

As was seen in Figures 3 and 4, however, the reproductive advantage of the wealthier classes does not last throughout the whole period. Table 5 illustrates the results of the same regression, but where we divide the data into 50-year periods. Since the focus of our work is to compare fertility of the wealthier to that of the poorer classes, we only report the coefficients of groups 6 and 7 as opposed to groups 1 and 2, as well as the number of additional children that groups 6 and 7 are predicted to have.

As also indicated in Figures 3 and 4, groups 6 and 7 have more than one additional surviving child compared to groups 1 and 2 at the

[8] Controlling for literacy drastically reduces the number of available observations, yet the results remain largely unaffected, even though standard errors on the parameter estimates are then much higher.

Table 5. *Regressing net fertility on social group by 50-year period*

Period	Groups	N	Constant	Coefficient	Std. error	Pseudo R^2	Extra children
pre-1575	6, 7 vs 1, 2	357	1.125	0.461***	0.113	0.025	1.802
1575–1624	6, 7 vs 1, 2	1,470	1.084	0.354***	0.061	0.023	1.256
1625–74	6, 7 vs 1, 2	1,789	1.089	0.226***	0.052	0.006	0.752
1675–1724	6, 7 vs 1, 2	2,203	0.861	−0.005	0.052	0.009	−0.011
1725–74	6. 7 vs 1, 2	2,744	0.444	−0.009	0.053	0.016	−0.014
1775–1824	6, 7 vs 1, 2	1,362	1.305	−0.175**	0.083	0.047	−0.593

*** significant at 1% ** significant at 5%

beginning of the period, but this difference becomes insignificant around 1700.

We also considered fertility differences by region within England, but we find no obvious systematic differences – a similar conclusion to that reached by Wrigley *et al.* (1997), although in marked contrast to that presented by Vann and Eversley (1992).

Summing up, the Cambridge data set confirms the first part of Clark's hypothesis, that wealthier social classes had more surviving offspring than their lower-class counterparts, although this only seems to hold true until the 1700s.

3.2. What explains fertility gaps between classes?

It is interesting to consider briefly how parents were able to regulate their fertility at a time of limited or no access to contraception.[9] Generally, demographers consider three main methods: delaying marriage (since most children were born within marriage), 'stopping' or the decision to stop having children before the menopause, and 'spacing', i.e. regulating time intervals between the birth of each child.

Figure 5 illustrates the mother's age at first marriage for 25-year periods. This clearly corresponds to the pattern we saw in Figure 3, since the groups with higher fertility simply got married earlier.[10] To begin with, these are the wealthier groups (based as usual on the occupation of the husband/father), but later these are the poorest groups. Regression results, reported in the appendix, confirm that this difference is statistically significant when looking at the period up to 1750. Note that we do not illustrate the pre-1575 period since here there are too few observations where we know the age of the mother (this is also the case for Figure 6, below).

[9] For a more detailed discussion, see the chapter on this in Wrigley *et al.* (1997).

[10] Also families who might have left the parish later on are included here. For exact sample sizes in this section see the Appendix.

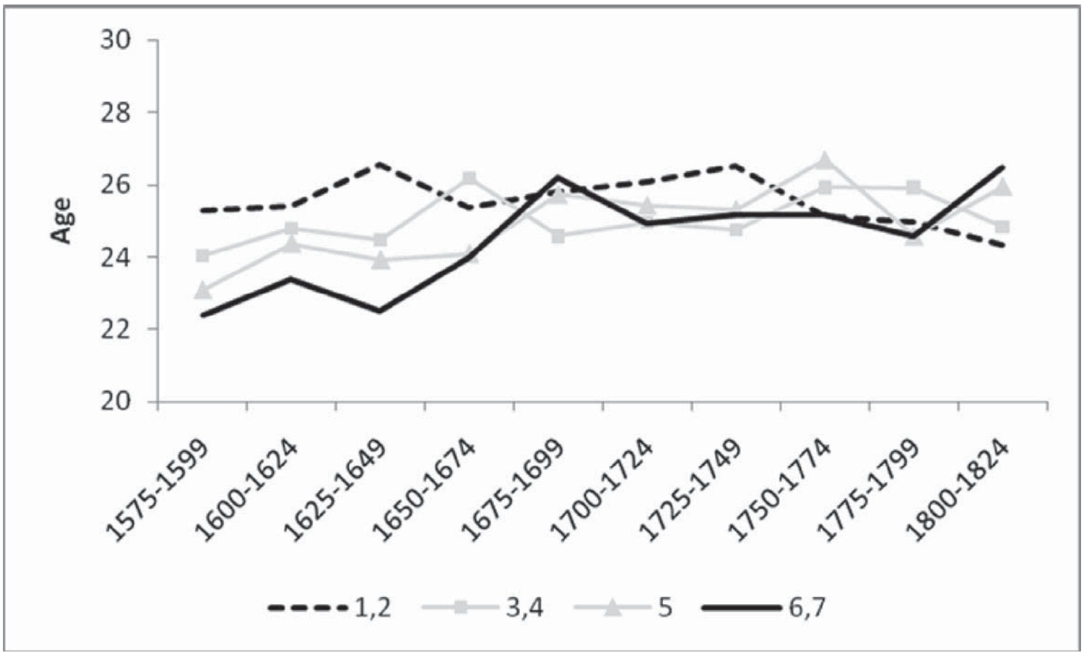


Figure 5. *Wife's age at first marriage*

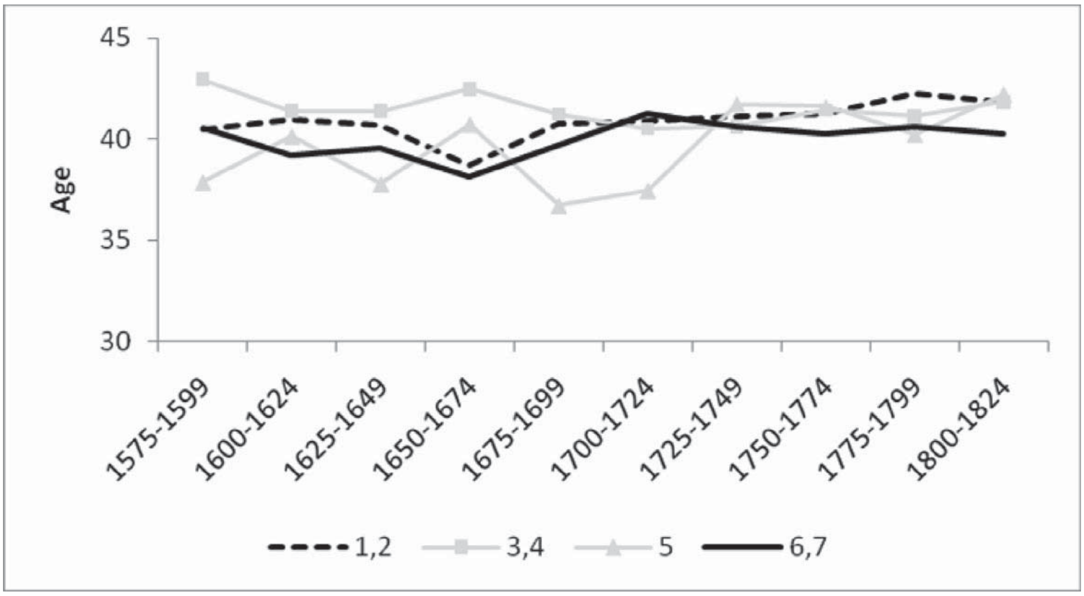


Figure 6. *Wife's age at last birth*

The fact that wealthier women got married two to three years earlier in the early years clearly prolonged the time span over which children could be born within marriage. Whether these parents, on average, fully enjoyed this as a longer fertile period, however, also depends on their 'stopping behaviour'. As Figure 6 demonstrates, the age of a wealthier woman at the time of the birth of her last child was slightly lower than that of the poorer groups.[11]

[11] Here, only 'completed' marriages are included, where the wife survived at least until age 50 and the husband did not die before that point in time.

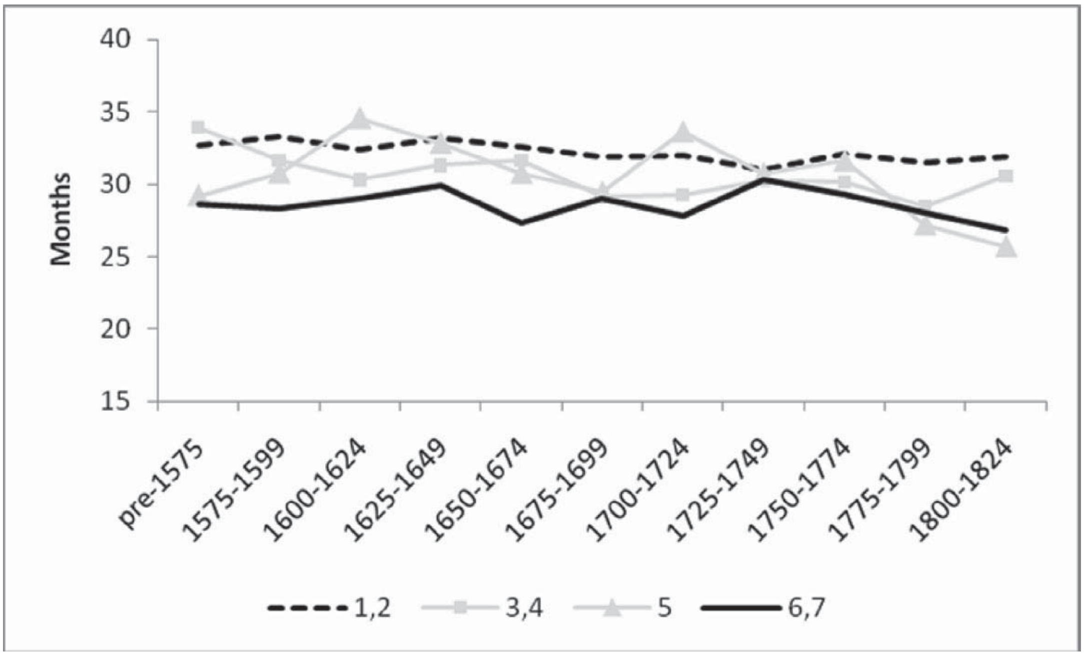


Figure 7. *Average length of birth interval (in months)*

Prior to 1700, women in groups 6 and 7 on average had their last child at the age of 39.05 whereas women in groups 1 and 2 had their last child at the age of 40.2. However, statistically this difference is not significant. Thus, wealthier families did indeed experience a longer fertile period than less wealthy parents.

Finally, we look at the 'spacing' intervals as illustrated in Figure 7.[12] As expected, the wealthier groups have shorter intervals between consecutive births, thus allowing them to have more children over the same time span.[13] Rather than a conscious choice, these differences were likely to do with the fact that women's fertility declines with age. Hence, since women in the higher groups got married earlier, they were more fertile at any particular birth order compared to women of the lower social group. This is confirmed by Table 6, where the average number of children (gross) of women in five-year age groups is calculated. Clearly, women in higher social groups had more children earlier in life. Later in life the pattern seems to reverse, although it should also be noted that this calculation does not take mortality into account.[14] Another explanation could be that women in the poorer

[12] Only the average number of months between all births is shown here. The average number of months between individual births (first to second, second to third, etc.) was also calculated but since the pattern of the groups was the same, only the aggregated measure is shown here.

[13] This difference is statistically significant at the 1% level; see the Appendix.

[14] Also note that this is the average number of children born to women who survived to a certain age group. Before we were looking at the total number of children born to a man throughout his life.

Table 6. *Average number of children by woman's age group*

	Age group						
Social group	15–19	20–24	25–29	30–34	35–39	40–44	45+
6, 7	0.317	1.197	2.034	1.759	1.586	0.521	0.085
5	0.170	1.327	1.980	2.222	1.500	0.788	0.063
3, 4	0.180	1.035	1.827	1.870	1.607	0.944	0.196
1, 2	0.090	0.814	1.802	2.030	1.607	0.791	0.168
N	720	712	680	634	561	501	486

groups had to work physically harder, or simply suffered from deficient nutrition or sanitary conditions, thus increasing their risk of miscarriage (see Livi-Bacci 1977 for a discussion on the relationship between living conditions and fertility in Italy).[15]

In conclusion, it seems that the reason why wealthier groups gave birth to more offspring was that less time went by between each birth, and also the fact that they married earlier, where the latter might explain the former.

3.3. Did society remain static?

For middle-class values to spread throughout society, it was of course necessary that the middle classes were not closed or cut off from the rest of society. If society was socially static, meaning that the middle class's fraction of society was constant, or if their proportion was falling over time, then given that they also had higher fertility, this would imply that their children would be forced to work in lower socio-economic groups. Figure 8 illustrates the evolution of the relative size of each of our seven social classes over time.

It does indeed seem that the data support Clark's hypothesis of a socially static society, since the shares were relatively constant up until the end of the seventeenth century. The poorest groups, 1 and 2, comprise around 40 per cent of society, while the richest groups, 6 and 7, are at around 20 per cent. Perhaps not surprisingly, given what we know about the huge structural changes taking place in England during the Industrial Revolution, something changes from the eighteenth century. Specifically, and not unexpectedly, groups 1, labourers, and 3, craftsmen, are growing as a share of society. Regarding the growth in the latter, this seems to be consistent with the findings of Leunig *et al.* (2009), who showed that education grew in importance over this period, particularly in the form of apprenticeships

[15] Note that the analysis here looks at *all* births, not taking into account whether the child died shortly after birth, or considering whether any birth order was the last birth – usually there was a longer interval to the last birth.

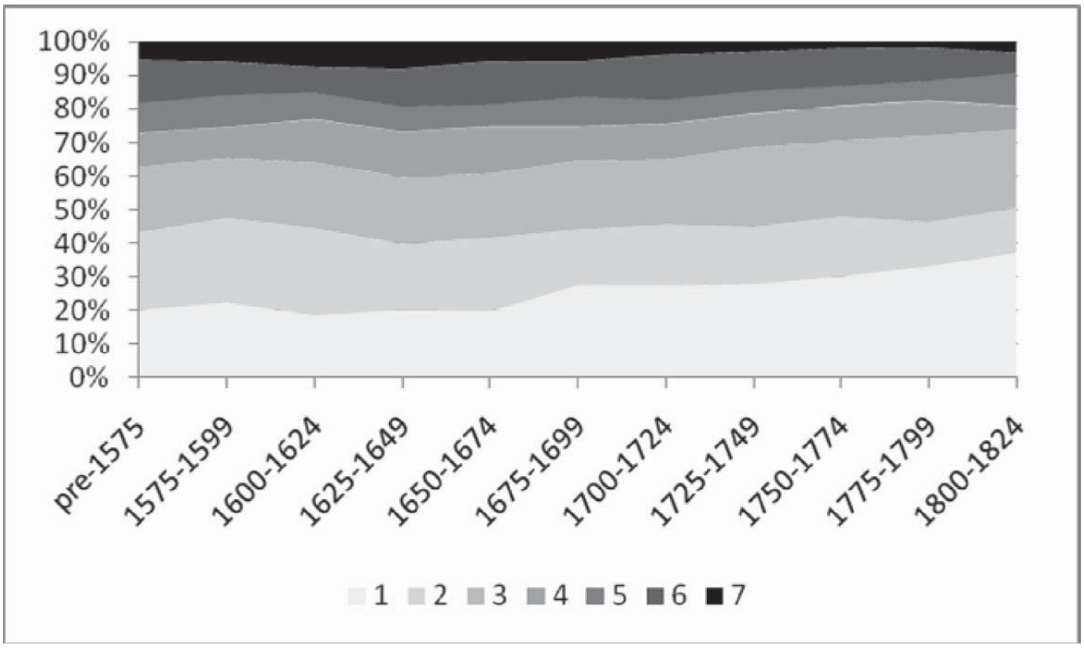


Figure 8. *Shares of social groups*

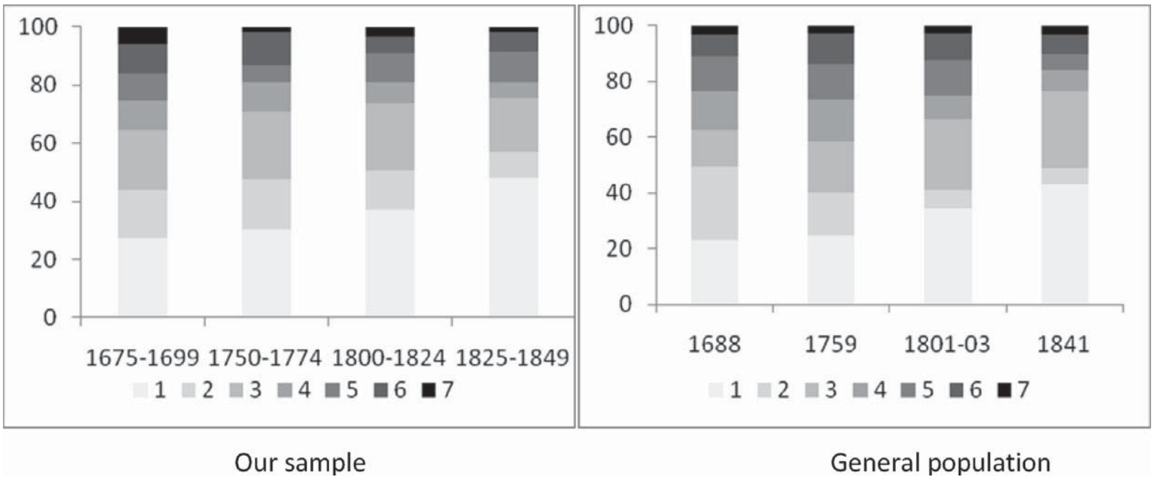


Figure 9. *Representativeness of the data*

Source for general population: 1688, 1759, 1801–3: Lindert and Williamson (1982); 1841: Booth (1886), Census.

requiring skills needed for manual labour, such as that used in manufacturing (van der Beek 2010).

More worrying is the precipitous decline in the share of groups 6 and 7 towards the end of the period, which we think implies that our sample becomes less representative of the whole country as the professional classes moved out of the rural parishes documented by the Cambridge Group and into the towns. This is consistent with a comparison of the occupational structure we find with that from various other sources, as illustrated in Figure 9.

The data for 1688 (Lindert and Williamson 1982) are aggregated into rather broad occupational categories, and are thus difficult to classify according to our groups. But the data still look acceptably similar to ours. From this date we have the same trend in group 1 (labourers) and 3 (craftsmen) as in the general population. Both for the estimates of 1801–3 as well as the census data from 1841 we can see that groups 6 and 7 are underrepresented in our sample. Indeed, this could be due to these people increasingly moving to cities, where we would not be able to observe them. Thus, for the analysis of social mobility in Section 4 below, we concentrate on the period before 1750 where our data seem to be largely representative of the general population.

4. Memes or genes?

Clark's hypothesis and his findings, which by and large can be supported with our data, raise some important questions, about which Clark himself seems rather agnostic. Of course, as mentioned in the introduction, there is no way to test whether the values considered by him really did spread through society in the way he suggests. But we can consider *how* they might have done so, given that we know that the offspring of the richer classes did indeed move down through society. In considering this, we move more into the realm of evolutionary biology, which is somewhat beyond the scope of this article. Nevertheless, we feel that our findings have some important implications for this debate.

Two mechanisms have been suggested for the propagation of values through society. The first relates to the so-called Lamarckian view (after the French biologist Jean-Baptiste Lamarck 1744–1829), that an organism can pass on characteristics acquired *during its lifetime* to its offspring. In a social context this corresponds to the transmission of memes, a word first suggested by Richard Dawkins (1976) to provide a framework for understanding the evolutionary principles underlying the spread of ideas and cultural phenomena.[16] The second, perhaps more controversial, theory suggests that these values might be intrinsic to individuals, because they are encoded in their DNA. Many social scientists might shy away from this interpretation, associated as it is with the work of eugenicists in the 1930s, but in reality the evolutionary forces governing the spread of genes or memes are rather similar. Economists are, in fact, leading the way in reopening the debate about the role of genetics for society, starting with the pioneering work of Gary S. Becker (1976). More recently, this has become a growing area of interest for those working within the field of Unified Growth Theory, relying as it does on the development of preferences for quality as opposed

[16] For more on this see Blackmore (2000).

Table 7. *Percentage of sons with marriage date observed*

	Pre-1750		Post-1750	
Father's social group	N (surviving sons)	% marriage date known	N (surviving sons)	% marriage date known
7	716	17.0	162	17.3
6	1,355	22.9	795	21.1
5	931	26.7	624	21.2
4	1,223	20.6	584	19.9
3	2,185	21.0	1,911	18.5
2	2,289	20.9	1,274	22.8
1	2,287	20.4	2,898	22.4
Total	10,986	21.3	8,248	21.0

to quantity of offspring (see Galor 2005, p. 231, and Galor and Moav 2002). What can our results tell us about whether memes or genes might have governed the transfer of middle-class values?

The Cambridge data permit us the possibility of going one step further in addressing the issue as *to what extent* middle-class values were trickling down by middle-class children leaving the social class in which they were born, because for a subsample of our sample, we have information on the occupations of both fathers and sons. We can use this to construct social mobility tables, as commonly used in sociology. Because we know that our data become less representative as we move into the period of the Industrial Revolution, we perform our analysis until 1750, where the year applied is the birth-year of the son.

Looking at social mobility causes us to dwell a little more on a problem with our data which we mentioned briefly above: namely, that even if a father stays in the same parish, his sons might migrate when they become adults. This could bias our mobility results if the sons from fathers of one group had a greater chance of moving out of the parish than those of the other groups. To get an idea of whether this might be the case, Table 7 shows the number of surviving sons the couples in our subsample (where we know the occupation of the father) have and the percentage of sons observed for each social group. The idea is that if they stay in the parish and get married, we would be able to observe the son, so differences in the proportions in each group for which we know the marriage date of the son would indicate differences in the tendency of sons to move out of the parish.

Fortunately, the percentages are similar at around 20 per cent for all groups, although we observe sons of group 7 slightly less often. This implies that group 7 will be slightly underrepresented in the mobility results. It is not clear whether these sons would follow the same mobility pattern as those staying in the parish, have a greater tendency to remain in group 7 or have greater downward mobility. This is not crucial to the results, but should be

Table 8. *Outflow mobility (row percentages), pre-1750*

	Son's group								
	7	6	5	4	3	2	1	Total	N
Father's group									
7	81.08	4.05	4.05	2.7	1.35	4.05	2.7	100	74
6	4.62	50	3.85	12.31	11.54	9.23	8.46	100	130
5	4.17	4.17	51.67	6.67	7.5	17.5	8.33	100	120
4	2.66	7.98	5.85	51.06	13.3	10.64	8.51	100	188
3	0.97	5.18	1.62	7.12	62.46	10.36	12.3	100	309
2	0.31	5.57	6.81	5.88	13	51.7	16.72	100	323
1	0	4.37	1.98	6.35	17.86	15.08	54.37	100	252
Total	5.73	9.53	8.09	12.82	23.64	20.99	19.2	100	
N	80	133	113	179	330	293	268		1,396

kept in mind when interpreting the results on intergenerational mobility for this group.

When examining social mobility tables, one should be aware of the fact that for the higher classes there is only the possibility of staying high in society or moving down, whereas the lower classes are only faced with the possibilities of staying low or moving up. The former is, however, exactly what we are looking for, namely the fact that the additional children of the higher classes had only one way to go. Taking this as a starting point, we are only interested in the degree of downward mobility of the higher classes and the degree of upward mobility into these classes.

First, we look at outflow mobility: see Table 8. This shows us the destination classes of sons contingent on their father's social class. Diagonal numbers refer to the percentage of sons remaining in the social class of their fathers. From the row percentages, it can be seen that, on average, only around 50 per cent of group 6 fathers had sons remaining within the same group, with the remainder largely moving to lower groups. This was to some extent balanced by upward mobility into these classes (shown by the column percentages), but there is no escaping the fact that there was mainly downward mobility from the richer groups. This is in line with our previous results, that these groups had higher fertility at a time of a static social structure.

It might be noted that the greatest mobility, in terms of both upward and downward mobility, was between groups 6 and 4, the non-manual occupations, in line with modern findings of a 'buffer-zone'. This has been widely observed for Britain in more recent times, e.g. Heath and Payne (2000) and Miles (1999), although this is most stringent when looking at relative mobility rates (relative to perfect mobility), as noted by Goldthorpe, Llewellyn and Payne (1980). As for group 5, most mobility occurs with group 2, as could be expected taking into account that both of these groups

Table 9. *Inflow mobility (column percentages), pre-1750*

	Son's group								
	7	6	5	4	3	2	1	Total	N
Father's group									
7	75	2.26	2.65	1.12	0.3	1.02	0.75	5.3	74
6	7.5	48.87	4.42	8.94	4.55	4.1	4.1	9.31	130
5	6.25	3.76	54.87	4.47	2.73	7.17	3.73	8.6	120
4	6.25	11.28	9.73	53.63	7.58	6.83	5.97	13.47	188
3	3.75	12.03	4.42	12.29	58.48	10.92	14.18	22.13	309
2	1.25	13.53	19.47	10.61	12.73	57	20.15	23.14	323
1	0	8.27	4.42	8.94	13.64	12.97	51.12	18.05	252
Total	100	100	100	100	100	100	100	100	
N	80	133	113	179	330	293	268		1,396

concern agricultural occupations. Group 7 seems to be most persistent, with around 80 per cent of sons born in this group being able to stay. This is somewhat intuitive as this group is largely concerned with titles, rather than with occupations. Nevertheless, here we also observe that downward mobility, especially to the lowest groups of labourers, is generally larger than upward mobility of these groups into group 7.

Although we have now demonstrated that there was indeed downward mobility from the richer groups, it is important also to consider patterns of inflow mobility, i.e. where the members of each group came from, as shown in Table 9. This is crucial for understanding the impact potential of this downward mobility. As can be seen, only around 5 to 10 per cent of groups 1 to 5 came from groups 6 and 7, whereas around 50 per cent of group 6 and around 20 per cent of group 7 came from lower income groups. This reflects the fact that, despite the downward mobility from the richer groups, they were a relatively small share of the population,[17] so their impact on the other groups was fairly minor. On the other hand, small movements from the lower income groups had a large impact on the higher income groups.

What does this imply for the idea that middle-class values were spreading through society? Leaving aside the question of whether groups 6 and 7 really did reflect the values which Clark associates with the middle class, it is difficult to draw clear conclusions. The mobility into lower groups was certainly rather little in relation to the large size of these groups, and besides, many were moving up the other way. However, it could be the case that the great mobility of English society could lead to a demonstration effect, whereby other socio-economic groups learnt by example from the offspring of the rich. On the side of the genetic argument, even a small reproductive advantage could cause certain individuals to dominate if their genes were

[17] Miles (1999) draws the same conclusion for the 1800s based on historical evidence.

being mixed into all tiers of the population over a long enough period of time.

In both cases, it was the great *mobility* of English society which could have given rise to the sort of phenomenon Clark suggested, but we are still not much closer to knowing whether it really did happen. The changing view of genetics amongst modern biologists does not make the job any easier. A rather brief foray on our part into the recent literature shows that the general belief that genetics somehow determines phenomes (i.e. appearance, physiology, behaviour etc.) is incorrect. What is known as developmental plasticity means that genes can be 'activated' or 'deactivated' depending on environmental conditions.[18] The implications of this are rather profound. It might well have been the case that certain attributes began to be favoured in the English population prior to the Industrial Revolution, but was this due to genetic or memetic mutation and reproductive success, or simply due to the activation of certain genes given new environmental conditions? If the latter was the case, the differing reproductive success of social groups becomes an interesting statistical finding, but perhaps of little or no long-run practical importance whatsoever.

One final point: much interesting work has been done recently on historical social mobility, and it is natural to compare our results with this. Generally, the levels of social mobility in Britain found for the nineteenth century are considered to be rather low, although increasing again in the twentieth century (see, for example, Ferrie and Long 2010). Our evidence suggests a longer story of high but decreasing social mobility before the nineteenth century, although much needs to be done to make our work fully comparable to studies of more recent years, where the methodology and the classification of socio-economic groups is usually rather different. There remains in fact plenty of room for more research based on the evidence from the Cambridge data, not just in extending this analysis to the period after 1750, but also in investigating intra-generational mobility, since we sometimes have observations for one individual of both occupation at marriage and at death (see the work from the nineteenth century by Long 2010).

5. Conclusion

This study offered an attempt to investigate the notion forwarded by Greg Clark that the spread of middle-class values to lower social classes, through social mobility, might have been a stimulus to England's Industrial Revolution. We used data from the Cambridge Group's population history

18 Memes can then impact on genes as, for example, maternal effects or cultural transmission passes information about the environment between generations. For a popular explanation of modern views of genetics, see Shenk (2010). For a textbook account see West-Eberhard (2003).

of England from family reconstitution to carry out two specific analyses required to test Clark's hypothesis. One was to find out whether middle-class families were more successful in terms of reproduction than their lower-social-class counterparts. The other was to test if pre-industrial England was socially static over time. According to the Cambridge data, both were true up until sometime in the eighteenth century.

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Appendix

A *Main occupations in social groups*

Group 7	N	Per cent
Bachelors	46	10.22
Esquires	39	8.67
Gentlemen	347	77.11
Knights	12	2.67
Others	6	1.33
Total	450	100
Group 6		
Teachers	41	3.8
Clerics	81	7.52
Clerks	113	10.49
Government officials	43	4
Higher working proprietors	410	38.08
Medical. dental. veterinary and related workers	96	8.91
Brewers	68	6.31
Masters	73	6.78
Others	152	14.11
Total	1, 077	100
Group 5		
Farmers	718	98.22
Others	13	1.78
Total	731	100
Group 4		
Lower working proprietors	111	10.22
Innkeepers	228	20.99
Tanners	146	13.45
Millers	83	7.64
Butchers	216	19.89
Bakers	151	13.9
Malters	48	4.42
Others	103	9.49
Total	1, 086	100
Group 3		
Textile workers	192	9.04
Tailors	387	18.21
Cabinetmakers and related woodworkers	199	9.36
Stone carvers	91	4.28
Blacksmiths	167	7.86
Bricklayers and other construction workers	188	8.85
Carpenters	357	16.81
Others	544	25.59
Total	2, 125	100

A *Continued.*

Group 2		
Husbandmen	635	34.08
Agricultural workers	216	11.59
Fishermen	74	3.97
Weavers	299	16.05
Shoemakers	323	17.34
Others	316	16.97
Total	1,863	100
Group 1		
Servants	122	4.7
Farm workers	57	2.2
Seamen	314	12.11
Labourers	1,798	69
Paupers	207	7.98
Others	95	3.66
Total	2,593	100

B *Regression results: surviving sibship size*

Period: pre-1750

Negative Binomial Regression				Number of obs = 7047		
				LR chi2(28) = 223.01		
Dispersion = mean				Prob > chi2 = 0		
Log likelihood = −14957.6				Pseudo R2 = 0.0074		

SurvSibshipSize	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Group 7	0.166	0.048	3.470	0.001	0.072	0.260
Group 6	0.208	0.035	5.970	0.000	0.140	0.277
Group 5	0.164	0.040	4.100	0.000	0.085	0.242
Group 4	0.136	0.035	3.910	0.000	0.068	0.204
Group 3	0.093	0.029	3.170	0.002	0.036	0.151
Group 2	0.105	0.029	3.600	0.000	0.048	0.163
Aldenham	0.121	0.095	1.270	0.205	−0.066	0.308
Ash	0.050	0.113	0.440	0.658	−0.171	0.271
Austrey	0.196	0.095	2.060	0.039	0.010	0.383
Banbury	0.053	0.084	0.630	0.530	−0.111	0.217
Birstall	0.265	0.091	2.920	0.004	0.087	0.444
Bottesford	0.165	0.090	1.830	0.068	−0.012	0.342
Bridford	0.282	0.132	2.140	0.032	0.024	0.540
Colyton	0.099	0.091	1.090	0.275	−0.079	0.276
Dawlish	0.198	0.199	1.000	0.319	−0.191	0.587
Gainsbro	−0.066	0.083	−0.800	0.425	−0.230	0.097
Gedling	−0.117	0.261	−0.450	0.654	−0.628	0.394
GreatOakley	−0.241	0.103	−2.340	0.019	−0.443	−0.039
Ipplepen	0.189	0.129	1.460	0.144	−0.065	0.442
Lowestoft	−0.164	0.086	−1.900	0.057	−0.333	0.005
March	−0.157	0.106	−1.480	0.140	−0.364	0.051
MorchardBishop	0.188	0.151	1.250	0.212	−0.107	0.483
Odiham	0.113	0.098	1.150	0.250	−0.079	0.304
Reigate	−0.019	0.090	−0.210	0.834	−0.194	0.157
Shepshed	0.156	0.093	1.680	0.093	−0.026	0.337
Southill	0.086	0.087	0.980	0.325	−0.085	0.257
Terling	0.277	0.199	1.390	0.165	−0.114	0.668
Willingham	−0.094	0.127	−0.740	0.458	−0.342	0.154
constant	0.944	0.083	11.340	0.000	0.781	1.108
/lnalpha	−1.271	0.042			−1.352	−1.189
alpha	0.281	0.012			0.259	0.305
Likelihood-ratio test of alpha=0: chibar2(01) = 1286.92					Prob>=chibar2 = 0	

C *Regression results: marriage age*

Period: pre-1750

OLS Regression

Number of obs = 1597
F(25. 1597) = 3.160
Prob > F = 0.000
R-squared = 0.047
Adj. R-squared = 0.032
Root MSE = 4.913

MarriageAge	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Groups 6&7	−1.069	0.383	−2.790	0.005	−1.820	−0.318
Group 5	−1.734	0.523	−3.320	0.001	−2.760	−0.708
Groups 3&4	−0.681	0.289	−2.360	0.019	−1.249	−0.114
Aldenham	−2.246	1.685	−1.330	0.183	−5.551	1.059
Ash	0.390	2.096	0.190	0.852	−3.720	4.500
Austrey	−0.894	1.483	−0.600	0.547	−3.803	2.016
Banbury	−0.246	1.330	−0.180	0.853	−2.854	2.363
Birstall	−1.191	1.340	−0.890	0.374	−3.819	1.437
Bottesford	0.519	1.399	0.370	0.710	−2.224	3.263
Bridford	−0.017	2.176	−0.010	0.994	−4.286	4.252
Colyton	0.333	1.395	0.240	0.811	−2.404	3.070
Dawlish	7.381	3.115	2.370	0.018	1.272	13.490
Gainsbro	−0.732	1.321	−0.550	0.579	−3.322	1.858
Gedling	−0.884	1.971	−0.450	0.654	−4.749	2.981
GreatOakley	1.701	2.025	0.840	0.401	−2.271	5.673
Ipplepen	0.560	2.786	0.200	0.841	−4.903	6.024
Lowestoft	−0.657	1.343	−0.490	0.625	−3.292	1.978
March	1.514	3.714	0.410	0.684	−5.771	8.799
MorchardBishop	3.275	1.879	1.740	0.082	−0.410	6.961
Odiham	−1.465	1.436	−1.020	0.308	−4.282	1.352
Reigate	−1.121	1.414	−0.790	0.428	−3.895	1.653
Shepshed	1.484	1.408	1.050	0.292	−1.277	4.245
Southill	−1.243	1.402	−0.890	0.376	−3.992	1.507
Terling	1.491	3.714	0.400	0.688	−5.795	8.776
Willingham	1.211	2.025	0.600	0.550	−2.761	5.183
constant	26.030	1.313	19.820	0.000	23.455	28.606

D *Regression results: mother's age at last birth*

Period: pre-1750

OLS Regression

Number of obs = 801
F(24. 776) = 1.320
Prob > F = 0.137
R-squared = 0.039
Adj. R-squared = 0.010
Root MSE = 5.852

AgeLastBirth	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Groups 6&7	−0.153	0.627	−0.240	0.808	−1.384	1.079
Group 5	−1.253	0.941	−1.330	0.183	−3.099	0.594
Groups 3&4	0.355	0.507	0.700	0.484	−0.640	1.351
Aldenham	−0.370	2.351	−0.160	0.875	−4.985	4.244
Ash	3.608	2.552	1.410	0.158	−1.401	8.618
Austrey	−0.601	2.136	−0.280	0.779	−4.795	3.593
Banbury	0.360	1.771	0.200	0.839	−3.117	3.837
Birstall	−1.194	1.753	−0.680	0.496	−4.635	2.246
Bottesford	1.447	1.908	0.760	0.449	−2.300	5.193
Bridford	0.547	2.801	0.200	0.845	−4.952	6.045
Colyton	1.721	1.927	0.890	0.372	−2.062	5.504
Dawlish	−2.229	3.752	−0.590	0.553	−9.594	5.136
Gainsbro	0.682	1.734	0.390	0.694	−2.722	4.086
Gedling	0.213	4.485	0.050	0.962	−8.591	9.018
GreatOakley	4.494	4.453	1.010	0.313	−4.247	13.235
Ipplepen	−1.151	3.396	−0.340	0.735	−7.817	5.514
Lowestoft	−0.247	1.777	−0.140	0.890	−3.735	3.242
March	0.400	4.482	0.090	0.929	−8.399	9.199
MorchardBishop	0.365	2.909	0.130	0.900	−5.346	6.075
Odiham	−2.875	2.037	−1.410	0.159	−6.875	1.124
Reigate	0.577	2.087	0.280	0.782	−3.520	4.673
Shepshed	1.521	1.930	0.790	0.431	−2.268	5.309
Southill	−0.193	1.908	−0.100	0.919	−3.938	3.551
Willingham	3.070	3.392	0.910	0.366	−3.588	9.727
constant	38.837	1.723	22.540	0.000	35.455	42.220

E *Regression results: average spacing*

Period: pre-1750

OLS Regression

Number of obs = 5993
F(25. 5967) = 6.790
Prob > F = 0.000
R-squared = 0.028
Adj. R-squared = 0.024
Root MSE = 12.976

AvrgSpacing	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Groups 6&7	−3.587	0.508	−7.070	0.000	−4.582	−2.592
Group 5	−1.040	0.685	−1.520	0.129	−2.383	0.302
Groups 3&4	−1.297	0.401	−3.230	0.001	−2.084	−0.510
Aldenham	1.952	1.731	1.130	0.260	−1.442	5.346
Ash	−0.825	2.050	−0.400	0.688	−4.844	3.195
Austrey	−0.173	1.678	−0.100	0.918	−3.462	3.116
Banbury	−1.939	1.438	−1.350	0.178	−4.759	0.880
Birstall	0.780	1.576	0.490	0.621	−2.310	3.870
Bottesford	−0.561	1.565	−0.360	0.720	−3.629	2.507
Bridford	5.158	2.369	2.180	0.029	0.514	9.801
Colyton	1.433	1.605	0.890	0.372	−1.714	4.580
Dawlish	2.032	3.729	0.540	0.586	−5.279	9.342
Gainsbro	−2.705	1.431	−1.890	0.059	−5.509	0.100
Gedling	12.189	4.333	2.810	0.005	3.695	20.683
GreatOakley	−3.373	1.819	−1.850	0.064	−6.939	0.193
Ipplepen	2.622	2.288	1.150	0.252	−1.863	7.107
Lowestoft	−0.140	1.471	−0.100	0.924	−3.024	2.743
March	−5.146	1.807	−2.850	0.004	−8.688	−1.604
MorchardBishop	−0.736	2.679	−0.270	0.783	−5.988	4.516
Odiham	−1.273	1.804	−0.710	0.481	−4.810	2.264
Reigate	0.899	1.572	0.570	0.567	−2.182	3.981
Shepshed	1.587	1.613	0.980	0.325	−1.576	4.750
Southill	−0.171	1.526	−0.110	0.911	−3.163	2.820
Terling	−0.953	3.431	−0.280	0.781	−7.679	5.774
Willingham	−2.131	2.197	−0.970	0.332	−6.437	2.176
constant	33.053	1.413	23.390	0.000	30.282	35.824

Chapter 3

North and South: More Evidence for the Social Mobility-Welfare Nexus from Historical England

Nina Boberg-Fazlić and Paul Sharp

North and South: More Evidence for the Social Mobility-Welfare Nexus from Historical England[1]

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Piketty (1995) formalizes the idea that historically high levels of social mobility can lead to a culture of non-acceptance of redistribution and welfare provision. We examine this hypothesis using data for historical England, where welfare provision was determined at the local level, allowing us to test the hypothesis within a single country. It has previously been noted that the North and South of England were culturally very different, with less acceptance of welfare in the North, reflected by lower levels of poor relief spending in the early nineteenth century. Looking at the period 1550-1850, we find higher levels of mobility in the North, consistent with the hypothesis.

JEL codes: J62, N33

Keywords: England, Poor Laws, social mobility, welfare

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1. Introduction

Does historical social mobility make people less accepting of redistribution and welfare spending? Already de Tocqueville (1835) and Marx (1852) observed contrasts in social attitudes in the US and Europe and ascribed these to differences in social mobility. Piketty (1995) formalized this idea and developed a model demonstrating that historically high levels of social mobility can lead to the development of beliefs in which welfare provision is less accepted: if everybody has the same opportunities, there will be less willingness to pay for those who are not able to care for themselves.[2] Here, we provide a test of this hypothesis by looking at historical mobility rates in England.

Recently, there has been great interest in international comparisons of social mobility, mainly due to increasing inequality in many countries. Cross-country studies show that countries with high income inequality also have low rates of social mobility. At the same time, high social mobility is usually considered desirable as it implies 'equality in opportunity' such that jobs are filled with those who are best qualified and not those who come from the right background (Corak, 2004). According to Piketty, however, countries with low rates of social mobility should be more accepting of redistribution and we should therefore expect low income inequality in these countries. The distinction between perceived mobility based on historical experience and current mobility rates is therefore crucial: although rates of social mobility are rather similar today, we need to look at historical rates in order to understand current attitudes.

The Piketty hypothesis thus suggests that there are long-run implications of social mobility due to its influence on the political and cultural attitudes of a population. Despite the observed pattern that countries with high inequality have lower social mobility today, the acceptance of inequality in a society stems from its long-run mobility experience. Historical social mobility rates can thereby help to understand why there are international differences in the extent of redistribution and the development of the welfare state. Linos and West (2003) and Fong (2001) provide evidence for a link between beliefs about social mobility and attitudes towards redistribution, using social survey data, but Long and Ferrie (2013a) examine the hypothesis

[2] We will hereafter refer to this idea as the Piketty hypothesis.

more directly by comparing mobility rates in the US and Britain and find evidence for higher levels of social mobility in the US in the nineteenth century, consistent with the fact that the US has developed much less of a welfare state than Britain in the twentieth century.

We investigate the Piketty hypothesis within a single country by taking advantage of the fact that welfare provision in England, until the twentieth century, was determined on a very local level: in particular, there were large differences in spending, especially between North and South England. We show that these variations in spending are likely to be due to cultural attitudes, as previously suggested by King (2000). We then use data which allows us to look at social mobility on a subnational level. We argue that this provides a 'cleaner' test of the theory than previous work, since we are effectively controlling for any type of country-specific factors that might be responsible for differences in mobility and welfare spending between two countries, such as the US and the UK. This exercise is possible because high quality micro-level family reconstitution data, linking occupations across generations, is available for historical England over a period of centuries, thanks to the labors of the Cambridge Group (see Wrigley, Davies, Oeppen and Schofield, 1997).

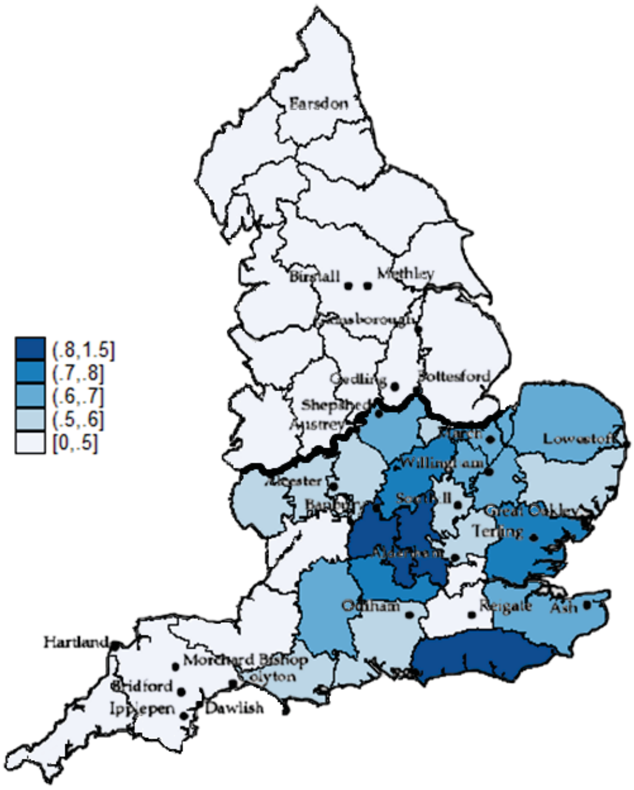
A major contribution of the present work is thus a thorough statistical examination of social mobility in historical England - something that has never previously been attempted. Not only do we find evidence of surprisingly constant levels of social mobility for the whole country over the very long run, but we also for the first time demonstrate how mobility differs on the subnational level. Moreover, since a large part of the population of the United States is descended from immigrants from the British Isles, we believe that the conjecture made by Long and Ferrie is greatly supported by the finding that the pattern they observe was also true for historical England.

2. Cultural differences and Poor Law spending

Blaug (1964) described the Poor Laws as effectively 'a welfare state in miniature'. They were first institutionalized by law in 1601, but administration was handled at the parish level.

Although there is no evidence on the parish level as to when the Poor Laws were implemented, as the Webbs (1927) noted, already by 1630 there is evidence for widespread implementation of poor relief. Indeed, Slack (1990) finds that around 1600 most larger towns had poor relief systems in place, mostly located in the southeast of England. By 1660, this was true for around one third of the parishes and by 1700 poor relief was universal. The parishes in the Cambridge Group data, which we discuss below, were rural in character but generally larger than the average parish in England at the time (Wrigley et al., 1997). They were thus probably not among the first parishes to implement poor relief, but it seems fair to assume that poor rates were in place by 1660.

Thus, although all poor were guaranteed relief, exactly how much was offered and who was eligible was decided by the individual parish. In fact, the levels of relief provided, as well as the number of applications turned down, varied greatly. In particular, there seem to have been marked differences in the generosity of relief between North and South England. The South relieved both more people and gave higher relief per capita, as illustrated in Map 1. Even the famous Poor Law Amendment Act of 1834 (the ‘New Poor Law’) left this structure basically unchanged (Blaug, 1963), with the system only falling into decline during the twentieth century, leading to their total abolition after the Second World War, with the introduction of the modern welfare state.



Map 1: Per capita spending on poor relief by county 1803, population 1801.

Source: Marshall (1834)

As Map 1 shows, Poor Law spending essentially split the country into two, along the thick black line.[3] This does not seem to reflect patterns of income or wealth, which after industrialization showed no clear North-South divide, although until the 1790s the North had been relatively poor (Buckatzsch, 1950, Schofield, 1965 and Hunt, 1986). Indeed, we demonstrate below that income and wealth do not correlate with spending. Another potential explanation could be based on population density caused by higher technological progress leading to larger families. These families could in turn imply less need for poor relief by the parish since there would be a larger kinship network to fall back on. When mapping population density, however, no pattern

[3] It should be noted here that including the southwest of England, Devon and Cornwall, which also had low levels of Poor Law spending, in the 'North' makes no difference to our results, since there are few observations from Devon, and none from Cornwall.

similar to the distribution of per capita poor relief spending as shown on Map 1 emerges. Other measures of the extent of welfare spending would include the amount of poor relief spending per recipient and the number of recipients by population. These maps can be found in the Appendix. The comparability across counties of these measures is, however, disputed. Boyer (1990), for example, argues that per capita relief spending is the only reliable measure that can be compared across parishes and counties, since parishes counted the number of recipients differently.

The Poor Law Commissioners themselves expressed the belief that increasing poor relief expenditures during the second half of the eighteenth century were due to abuse of the system and a general disincentive effect of poor relief. This view was shared by economists and critics at the time, such as Malthus (1798) and Ricardo (1821). Revived interest in the poor laws in recent decades led to revisionist analyses (e.g. Blaug, 1963 and Boyer, 1990), which suggested that differences in poor relief spending were largely due to differences in economic structure. Boyer (1990) argued that relief expenditures were higher in those counties where poverty due to seasonality in agriculture was more prevalent: seasonal lay-offs had to be offset by poor relief in order to keep workers in the countryside. He concluded that relief expenditures were higher in areas more dependent on arable farming than those dependent on pastoral agriculture.[4] His analysis is, however, restricted to differences between parishes within the South of England. We examine whether this hypothesis is relevant for the whole of England in Table 1 by regressing spending on a measure of the suitability of the soil for arable farming as given by the Food and Agriculture Organization of the United Nations.[5] In the first column, we include this variable, plus a number of controls which might also be expected to determine welfare spending (see the discussion above): population density (as a proxy for income / agricultural productivity), a dummy for whether the county was one of the five wealthiest counties (from Buckatzsch, 1950), and the wage of agricultural laborers (from Hunt, 1986).

[4] See also Jewell (1994).
[5] 'Crop suitability index (class) for low input level rain-fed cereals', i.e. using traditional methods of agriculture, from GAEZ, Global Agro-Ecological Zones, at the Food and Agriculture Organization of the United Nations.

Table 1: Determinants of Poor Relief

OLS regression, per capita poor relief

	(1) ln(per capita Relief)	(2) ln(per capita Relief)
suitability	0.563 **	0.0938
	(0.23)	(0.215)
North		-0.636 ***
		(0.099)
lnpopdens	-0.011	-0.117 *
	(0.087)	(0.061)
top5wealth	-0.134	-0.108
	(0.22)	(0.14)
lnwage	-0.588	-0.084
	(0.386)	(0.258)
Constant	0.418	0.179
	(0.913)	(0.62)
Regional dummies	Yes	Yes
R^2	0.425	0.773
N	41	41

Robust standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

Although agricultural structure is highly correlated with welfare spending, it is not robust to the addition of a dummy for the North, as shown in the second column. With an R^2 of 77 percent for the North dummy alone, this is a clear indication that the North was different and that this difference does not stem from differences in agriculture alone.

More recently, King (2000) has used evidence from the whole country and fails to find evidence for lower levels of poverty in the North. He thus does not believe that these differences can be attributed to different kinds of unemployment because there was rather high poverty in both regions. There is no evidence that the same levels of relief could not be afforded in the North, or that there was no demand. Instead, he argues convincingly that the difference in welfare spending was due to cultural differences between the North and South. He denotes the North as exhibiting a 'harsh culture of making do', whereas the South was 'more relaxed and inclusive' with a 'culture of dependency'. He demonstrates that in general relief was granted later and to fewer people in the North, and they received lower payments than in the South. Also, the process of granting relief was more based on monitoring and in depth investigation in the North. Moreover, there was more focus on giving pensions to the elderly, whereas in the South also younger men in need received relief. In fact, in the North pensions only provided around one third of subsistence level income, whereas in the South the pension was around subsistence. He thus concludes that there was a deliberate choice to grant lower relief to fewer people – one based on culture.

The North-South divide is a well-known and debated phenomenon in Britain today. In fact it goes back much further than often thought. Famously, Gaskell's novel from 1855 presents a traditional class-ridden South of England and a dynamic industrializing North. In a recent study, Billinge (2012, p. 95) notes that the South exhibited 'an awareness of rank and a clear recognition of the status which even the lowest position in a strictly hierarchical society conferred' during the eighteenth and nineteenth century.

Naturally, we cannot really test whether there were cultural differences during or before the implementation of the Poor Laws. However, a central point of Piketty's work is that cultural values and beliefs are rather persistent, irrespective of what is otherwise happening – historical social mobility affects attitudes today, even if this mobility no longer exists. It is well known that there are still considered to be large differences between North and South even today: the North was more subject to the benefits and challenges of the industrial revolution, and was harder hit by the deindustrialization of the country during the twentieth century. Now the North is poorer, and more reliant on welfare. Might we then expect the North to be more accepting of welfare today, in contrast to the pattern we observe in Poor Law spending?

We use the results of the European Values Survey from 2008-2010,[6] to give us an idea as to cultural differences between the North and the South today, at a time when of course welfare decisions are decided centrally. Perhaps surprisingly, it turns out that the North still seems to be less accepting of welfare. We consider several questions from the European Values Survey, and Table 2 summarizes the results. We try to look at questions which reflect more underlying values rather than opinions which might be influenced by the current economic conditions in a particular region.

Table 2: Differences in answers to selected questions in EVS

Question	Scale	Difference in means (North-South)	N
To what extent are you concerned with the living conditions of…	1 (very much) - 5 (not at all)		
immediate family		0.342 ***	1144
		(0.097)	
people in neighbourhood		0.22 ***	1146
		(0.074)	
people in own region		0.192 ***	1145
		(0.066)	
fellow countrymen		0.261 ***	1145
		(0.064)	
elderly people		0.129 **	1151
		(0.061)	
unemployed people		0.061	1142
		(0.066)	
sick and disabled		0.15 **	1150
		(0.059)	
children from poor families		0.067	1151
		(0.058)	
Individual vs. state responsibility that everyone is provided for	1 (individual) - 10 (state)	-0.096	1148
		(0.139)	
How much freedom of choice and control over the way your life turns out	1 (none at all) - 10 (a great deal)	0.152	1150
		(0.127)	

Standard errors in parentheses
* p<0.10, ** p<0.05, *** p<0.01

[6] http://www.europeanvaluestudy.eu

We see that people in the North care significantly less about the living conditions of others than those in the South. Additionally, people in the North believe that it is more the individual's responsibility to provide for oneself and they feel that life is less predetermined. These last differences are however not significant. Of course, the difference is small, but considering the huge changes since the period we look at, and the relative poverty of the North, which might make them more biased towards an acceptance of welfare, this provides evidence that the cultural values we suggest have existed, and are fairly persistent.

Putting all this together, it seems probable that the fact that less welfare was provided in the North is due to cultural differences. If the Piketty hypothesis is true, we should then be able to find historically higher social mobility in the North. The next section thus focuses on calculating social mobility rates and demonstrating that there was a difference between the North and the South, as defined in Map 1.

3. Documenting differences in social mobility

3.1 The data

The data underlying our analysis is described fully elsewhere (see Wrigley et al 1997). We use family reconstitution data compiled by the Cambridge Group, collected from 26 parishes across England from around 1550-1850. The usual caveats that apply to family reconstitution data should be kept in mind: for a good discussion of these issues, see, for example, Ruggles (1999). Apart from birth, death and marriage dates, the data sometimes includes occupations. These were recorded at life events, mostly at marriage or death but also at births/baptisms or deaths of children. As occupations are mostly recorded for men, we restrict our analysis to intergenerational occupational mobility between fathers and sons. The representativeness of the subsample for which we have occupations is discussed at length by Boberg-Fazlić et al (2011): the occupational structure of the data used is very similar to that given by other studies, as one would expect if they are the result of a random draw from the entire population. One concern with the occupational information is that a large proportion of our observations in the

North come from just one parish, Gainsborough. We take account of this by including parish fixed effects in our regressions.[7]

We categorize the recorded occupations into four groups, following Long and Ferrie (2013a). These are listed in Table 3 below, together with some examples of the occupations they include. As mentioned earlier, occupations could be recorded at different points in time. For most individuals only one recording is available or the same occupation was recorded several times. If more than one occupation is available, we use the earliest possible recording. It would certainly be preferable to have occupations recorded at the same point in life for fathers and sons as in Long and Ferrie (2013a), although, on the other hand, our data has the advantage of providing a certain link between fathers and sons, since this is the basis of how the data were constructed – unlike the census data – and we make use of the same data source for the whole period, thus reducing the risk of potential biases occurring only in some periods.[8] We could choose to only include father-son pairs for which we have observations on occupations at marriage for both. Restricting ourselves to this sample, however, severely limits the number of observations, and prevents us from calculating the Altham statistics below. However, our measures of total mobility, and the regressions below, are unaffected if using the restricted sample.

Table 3: Occupational categories

Occupational categories	**Description**
White collar	professional, technical, managers, officials, proprietors, clerical, sales
Farmer	farm owners, farm managers
Skilled/Semi-skilled	craftsmen , operatives
Unskilled	service workers , laborers (including farm laborers)

[7] We have also run the analysis excluding Gainsborough and, though not significant because we lose a lot of observations, our results are otherwise unaffected.

[8] See Xie and Killewald (2013) for a discussion on potential biases in the data used in Long and Ferrie (2013a). See also Long and Ferrie’s reply (Long and Ferrie, 2013b)

There might be a number of more serious concerns about the data, however, which we address here. Most importantly, we only observe individuals as long as they remain in a certain parish. For the analysis of intergenerational social mobility this implies that we will only be able to link fathers and sons if the son gets married in the same parish as that in which he was born, and we cannot therefore capture those who are geographically mobile. Geographical mobility often occurred because of either good prospects for upward social mobility or a lack of opportunities to find work in the home parish. Whereas we cannot be sure whether those who leave the parish would be upwardly or downwardly mobile, the chances of them being relatively socially mobile are high, and our estimates of social mobility will therefore always present a lower bound. However, as long as there are no systematic differences in geographical mobility rates in North and South England this does not pose a problem for our analysis.

For the present study, it is especially important that there should be no geographical difference in the number of sons leaving the parish before marriage. As Table 4 demonstrates, the percentage of sons getting married in their parish of birth is rather similar for North and South England. Moreover, the percentage of men leaving their birth parish at some point in their life is very similar for North and South. We thus do not see that differing patterns of geographical mobility can affect our analysis. It could also be that geographical mobility occurred for different reasons in the North and the South. Geographical mobility might differ to the extent that people are pushed out due to lack of employment in one region and pulled into larger cities in the other region. Evidence for the period we are looking at, however, shows that geographical mobility in general was rather local with no obvious regional pattern (see for example Clark, 1979).

Table 4: Geographical mobility in North and South England

	men marrying in birth parish	men dying in different parish
North	16.0%	48.6%
South	12.2%	44.6%

Another issue with these data is that they only include married men: we can only observe the social mobility of sons born into a marriage and then in turn getting married. We are therefore unable to say anything about the social mobility of illegitimate sons or of sons who do not get married. However, for the period examined marriage was the norm.

3.2 Mobility Matrices and Altham Statistics

Our analysis of social mobility in England in this section follows that described by Long and Ferrie (2013a).[9] A simple measure of social mobility is the percentage of off-diagonal entries in the mobility matrix, i.e. all sons that have an occupational category different from their father's. This measure, however, does not take into account the degree of mobility possible in a certain time or place due to the particular occupational structure. This makes the comparison of mobility tables with different occupational structures difficult. In order to compare social mobility at different points in time or in different places, the marginal frequencies of one social mobility table are therefore adjusted to be equal to those of the other mobility table, and the proportion of off-diagonal entries are then compared (see Altham and Ferrie, 2007). In this way, social mobility occurring because of different occupational structures is filtered out. We can thus answer questions such as whether social mobility was higher in the North even if it had the same occupational structure as the South, and it allows for the comparison of social mobility rates over time.

A rather more sophisticated way of measuring social mobility is to employ the method developed by Altham (1970).[10] The Altham statistic measures the distance of a particular matrix to independence, i.e. to a matrix in which all entries are the same. In terms of social mobility this measures the distance of a particular social mobility table to perfect mobility, as perfect mobility is a situation in which the occupation of the father and the occupation of the son are independent from each other. When comparing two matrices we can also calculate the

[9] This was made very much easier by the availability of the Stata program for performing the analysis in the appendix of Altham and Ferrie (2007).

[10] The method has been criticized for not being able to decompose total mobility into structural and exchange mobility (Hout and Guest, 2013). We choose this method to be able to compare our results to those of Long and Ferrie (2013a) and due to the advantages of the method, discussed above and in Long and Ferrie (2013a and 2013b).

distance between the two. This has the advantage that we can get a significance level for the difference in mobility across time or place (see Altham and Ferrie, 2007 for a more detailed discussion of this methodology). Thus, for two matrices **P** and **Q** with *r* rows and *s* columns, it is possible to calculate how far the association between rows and columns in **P** departs from that in **Q** using the following statistic:

$$d(\mathbf{P},\mathbf{Q}) = \left[\sum_{i=1}^{r}\sum_{j=1}^{s}\sum_{l=1}^{r}\sum_{m=1}^{s}\left|log\left(\frac{p_{ij}p_{lm}q_{im}q_{lj}}{p_{im}p_{lj}q_{ij}q_{lm}}\right)^{2}\right|\right]^{1/2} \quad (1)$$

We start by considering the level of mobility in England as a whole. Figure 1 illustrates the simple measure of mobility for each period, **M’**, i.e. the number of off-diagonal entries for each period, where each matrix is given the same marginal frequency as that of 1850-1880. Also shown are the Altham statistics, d(X,I), giving the distance to perfect mobility in each period. The last two periods are taken from Long and Ferrie (2013a). Since their sample includes sons who are geographically mobile it is not surprising that they find higher mobility rates, but generally there seems to be no clear trend in social mobility over the period 1550-1850.

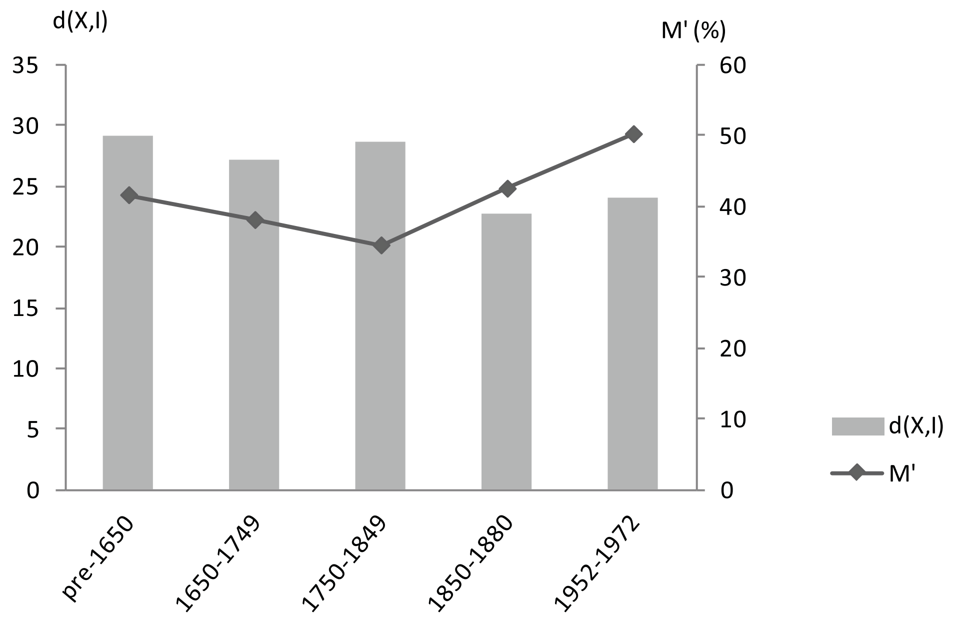


Figure 1: Social mobility in England from the sixteenth to the twentieth centuries

Taken together with the results of Long and Ferrie (2013a), who also find little change in mobility in Britain between the nineteenth and twentieth centuries, our results suggest perhaps surprisingly constant mobility over five centuries. Work on social mobility before the nineteenth century is limited, although it is touched on by Boberg-Fazlić et al (2011). Ongoing work by Clark and Cummins (2012), based on an analysis of surnames, does, however, seem to back up our findings. They find little change in mobility rates from medieval England until today, institutional developments such as universal education and suffrage notwithstanding. They thus argue that, given the modest effects of major institutional changes on social mobility, the important determination of persistence is transmission within families.

We then turn to the main question of interest for the present work: was there a difference in social mobility between the North and the South of England? As far as we are aware, no other studies have considered regional patterns of social mobility. As above, we divide our data into three periods, which relate to the comparison we want to make with the Poor Laws: first, we consider the years before 1650, which was the period when the Poor Laws were being established; second, we consider the period 1650-1749, which was one in which poor relief was established in all parishes; and finally we consider the period 1750-1849, when there was the explosion in expenditures which led to the Poor Law Amendment Act of 1834 and heavy cuts. In relation to this it should be noted that the vast majority of our observations come from before 1834. Also, for most of the following, we exclude the group of 'farmers', who are very few in number (see also Long and Ferrie, 2013a) – the matrices underlying our subsequent analysis are reported in the appendix. Including farmers often leads to zero entries in the social mobility matrices, which makes the calculation of the Altham statistics impossible (see equation 1). Also, farmers usually exhibit a rather unique pattern of mobility, based on direct inheritance of the farm. This may pose some problems in applying the same method of measuring mobility to farmers and other occupations (Xie and Killewald, 2013). Table 5 provides summary measures of mobility in England, where we compare the North and the South. It should be noted that for the comparison, M in the North (South) should be compared to M' in the South (North), since here the marginal frequencies in M' have been put equal to that of M. d(N,I) gives the Altham statistic for the North, compared to perfect mobility, as does d(S,I) for the South. d(S,N) gives the distance between the matrices for the South and the North.

Although one would mostly be concerned with the absolute mobility occurring in the region, in order to compare mobility in the two regions we adjust the mobility measures of the North to the occupational structure of the South. Absolute mobility is shown in the first column of Table 5.

Table 5: Summary measures of mobility in North and South England

		with farmers		without farmers				
		M	**M'**	**M**	**M'**	**d(N,I)**	**d(S,I)**	**d(S,N)**
pre-1650	**North**	40.0	38.8	38.8	37.8	8.9 ***		
	South	38.1	37.5	34.0	35.8		11.7 ***	4.0 ***
1650-1749	**North**	39.7	41.7	37.8	35.7	11.5 ***		
	South	32.8	32.3	29.0	30.6		13.6 ***	3.6 ***
1750-1849	**North**	40.4	41.2	38.7	40.4	10.1 ***		
	South	30.2	30.0	27.3	27.2		15.6 ***	6.7 ***

** $p<0.05$; *** $p<0.01$

The results in Table 5 demonstrate clearly that, consistent with our hypothesis, social mobility was in fact significantly higher in the North in all periods. Figure 2 illustrates this graphically. Since a taller bar implies that the matrix is further from perfect mobility, this seems to suggest that social mobility was actually decreasing in the South over time, while it was relatively constant in the North. The difference is greatest in the final period, perhaps because of the early industrialization helping maintain mobility in the North despite declining total mobility.

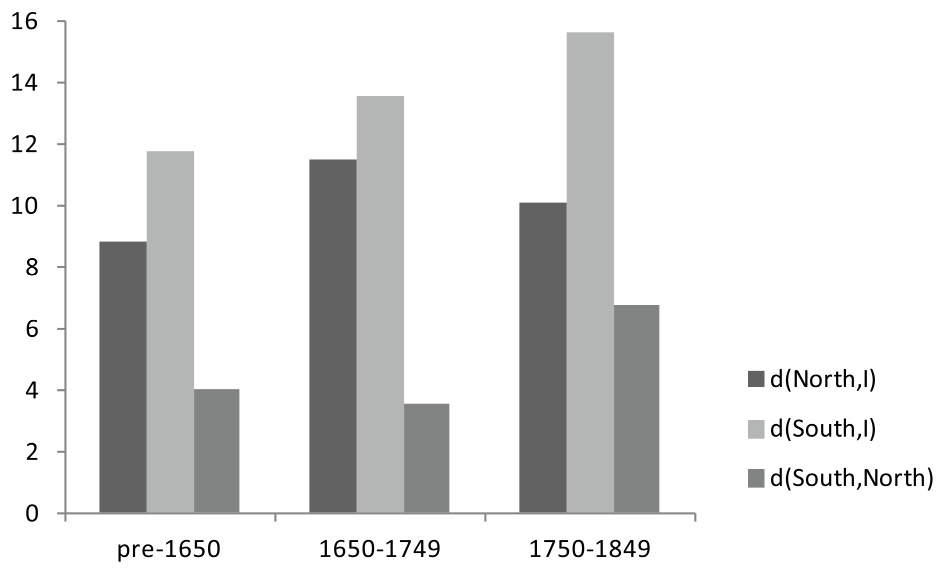


Figure 2: Altham statistics for North and South England, 1550-1849

In fact, if we divide the country into five regions[11] (this is the most possible which gives us useable social mobility matrices), we find a clear negative correlation (-0.83) between poor relief spending and social mobility, as measured by M': see Figure 3. The correlation of the Altham statistic with poor relief per capita is 0.37. So the correlation has the right sign even at a more local basis than the North-South divide, although of course we cannot say anything about significance with just five observations.

[11] (Northumberland, Yorkshire, West Riding, Lincolnshire, Nottinghamshire); (Warwickshire, Leicestershire); (Devon); (Hampshire, Oxfordshire, Bedfordshire); and (Suffolk, Cambridgeshire, Essex, Hertfordshire, Surrey).

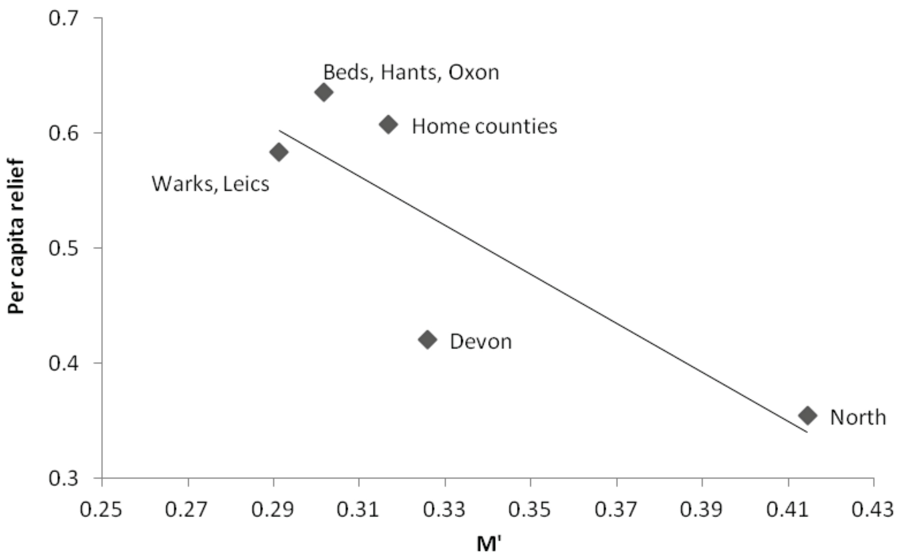


Figure 3: Total mobility and per capita relief by region

The southeastern counties cluster together with relatively low social mobility and high per capita expenditures on poor relief. The North stands out at the other extreme with relatively high social mobility and low per capita expenditures. Devon seems to be somewhere in between, which is in line with our analysis above. Thus, even on a more disaggregated, regional level we find evidence for the hypothesized relation between social mobility and welfare spending.

Following Long and Ferrie (2013a), we now proceed to decompose the differences in mobility between the North and the South for each period. This allows us to understand further the reasons for the differences. Tables with the components and their contribution to the total difference in mobility between North and South can be found in Appendix A3-A5.

For the pre-1650 period, the two most important factors are about entering skilled rather than white collar occupations. Together they describe almost half of the difference between mobility in the North and the South. In the South, if you have an unskilled father, you are 16 times more likely to enter a skilled rather than a white collar occupation, than if you have a white collar father. In the North this is only four times more likely: i.e. it is roughly four times more likely in the North. This difference is around 3 to 1 when comparing having a skilled rather than a white collar father. So the difference in total mobility is largely due to there being a greater barrier to moving into white collar occupations in the South.

For the period 1650-1749, the two most important contributors are about entering skilled rather than unskilled occupations. In the South, if you have an unskilled father, your chances of having a skilled occupation rather than an unskilled one are negligible. Although they are also very low in the North, they are nevertheless three times greater than in the South, and this accounts for 28 percent of the total difference in mobility. Moreover, the difference in the chances of entering a skilled rather than an unskilled occupation if you have a skilled father rather than an unskilled father are two times greater in the South than in the North. So for sons of unskilled fathers there is a greater barrier to entering skilled occupations in the South.

Finally, for the period 1750-1849 much of the difference in social mobility is due to the same reasons as given for the previous period. What is new is that it is much more likely in the South rather than the North that the son of an unskilled father also has an unskilled rather than a white collar occupation. This factor accounts for around one third of the difference in mobility between North and South.

To summarize, it seems that much of the difference in mobility between the North and South in every period is due to the relative ease with which the sons of unskilled fathers are able to move into skilled or white collar occupations. This implies lower upward mobility in the South, but we can look in more detail at the extent of upward and downward mobility using the matrices in the appendix. Here, as an example of upward mobility, we focus on the proportions of sons either in skilled or white collar occupations, despite having a father in the unskilled category. We also look at those sons entering unskilled occupations, despite having a father in a white collar or skilled profession. This is an example of downward mobility. We then compare the relative sizes of these statistics to determine whether there is more upward or downward mobility out of and into the unskilled occupations.[12] For the period before 1650, in the North 51 percent of all sons of unskilled fathers moved to skilled or white collar occupations before 1650, compared to 61 percent of those in the South. This difference disappears when using the marginal frequencies of the North (both 51 percent). Turning to downward mobility, in the North 19 percent of all sons moved into unskilled labor, compared to 11 percent in the South, but again the difference disappears when using the marginal frequencies of the North (both 19 percent). This does not contradict the findings above, since the difference in mobility between the North and the South is due to differences in entering skilled versus white collar occupations, and not differences in moving into or out of unskilled occupations. There is, however, clearly more upward mobility from than downward mobility to the unskilled occupations for the country as a whole.

Turning to the period 1650-1749, mobility out of unskilled occupations is 54 percent for the North compared to 43 percent for the South, and this changes very little even when using the marginal frequencies for the North (54 versus 42 percent). In terms of downward mobility, 19 percent moved into unskilled occupations in the North compared with 14 percent in the South (15 percent using the marginal frequencies of the North). There is thus more upward mobility than downward, but both upwards and downwards mobility were greater in the North, and this has nothing to do with differing occupational structures.

For the final period, 1750-1849, there is a similar pattern: 57 percent versus 27 percent (or 41 percent) upward mobility; and 20 percent versus 21 percent (or 13 percent) for downward mobility. Here the different occupational structures clearly make a large difference, as might be expected considering what we know about the industrialization of the North, but when accounting for this, the differences seem similar to in the previous period: both upward and downward mobility are considerably greater in the North.

[12] We could also have looked at movement into and out of the skilled and white collar categories, but we decide to leave this, since the relative ranking of the occupations is less clear here. For example, is it really upward mobility if the son of a skilled artisan becomes a school teacher? Certainly the amount of education required is not necessarily less. The ranking thus seems clearer between unskilled occupations and the others.

3.3 Intergenerational Elasticity of Earnings

A complimentary way of estimating social mobility to the above is to calculate the intergenerational elasticity of earnings (IGE), i.e. the elasticity of a son's income with respect to that of his father (see for example Solon, 1992). To do this, however, we need to assign incomes to our occupations, which we do using the wage estimates by Williamson (1982). He reports wages for 18 occupational groups, where each group comprises a number of similar occupations. If the occupation in our data is available in one of these groups, we assign the wage of that group. If not, we assign an average of similar groups, see Appendix A6 for details.

Williamson's data also covers various years. However, the earliest wage series is from 1710, so in order to match as well as possible with our observations, we break our data into the same periods as above, and assign the 1710 series to all father-son pairs where the son was born before 1650. For those born between 1650 and 1749 we use an average of the wages from 1710 and 1737. Finally, we use an average of the wages from 1755, 1781, 1797, 1805, 1810, 1815, 1819, 1827 and 1835 for those born between 1750 and 1850. This wage data has been criticized, especially for its large variation across time for some occupational groups (Jackson 1987, Feinstein 1988), but since this is mostly supposed to be a problem for the later periods, it should not be a problem for our analysis. Moreover, averaging across time removes some of that variation.

In Table 6, we thus regress the logarithm of the father's wage on the logarithm of the son's. We add a dummy for the North of England, and interact this with the son's wage in order to get an estimate of the difference in IGE between North and South. We also add time dummies for our periods, which we also interact with the elasticities. Finally, we include parish fixed effects.

Table 6: Intergenerational Elasticity of Earnings

OLS regression, IGE of earnings	
	ln(wage)
ln(father_wage)	0.343 ***
	(0.046)
North	0.198
	(0.193)
ln(father_wage)*North	-0.122 ***
	(0.048)
P1650-1749	-0.17
	(0.173)
P1750-1849	-0.00169
	(0.181)
P1650-1749*North	0.0358
	(0.036)
P1750-1849*North	0.147 ***
	(0.046)
ln(father_wage)*P1650-1749	0.0532
	(0.054)
ln(father_wage)*P1750-1849	0.0936 *
	(0.054)
Constant	2.205 ***
	(0.15)
Parish fixed effects	yes
R^2	0.455
N	5,719

Robust standard errors in parentheses, clustered at the family level
* p<0.10, ** p<0.05, *** p<0.01

In line with our findings above, we find social mobility to be higher in the North, with an elasticity of 0.221, than in the South, at 0.343. Although these estimates are rather low, they are in line with others (which for studies on modern data range between 0.22 and 0.42 according to a survey by Corak, 2006). For the whole of Great Britain, Long (2013) finds an IGE between 0.359 and 0.366 for the period 1851-1881.

A recent literature has emerged which demonstrates that taking account of the influence of grandparents can substantially reduce estimates of social mobility (see Long and Ferrie, 2012 on occupational mobility or Lindahl, Palme, Massih and Sjögren, 2012 on the persistence of human capital). The intuition is that 'errors' from one generation to the other, for example a lawyer from a family of lawyers whose son decides to drop out of law school in order to join the circus, are corrected over more than two generations: the grandson is likely to be influenced by the longer family history.

For a relatively small subset of our data, 1,061 families, we have information on three generations. Table 7 thus repeats our regression above, where we have included the income of grandfathers, but removed the parish and time fixed effects due to the limited sample. In the first column, we estimate the model without the grandfather effects on the new limited sample, for the sake of comparison. Of course, the IGE is higher, since we are now looking at a subsample of extremely immobile people, who have been in the parish for at least three generations.

Table 7: Intergenerational Elasticity of Earnings

IGE of earnings, three generations

	(1)	(2)
	ln(wage)	ln(wage)
ln(father_wage)	0.647 ***	0.52 ***
	(0.032)	(0.044)
ln(grandfather_wage)		0.174 ***
		(0.039)
ln(father_wage)*North	-0.111	-0.086
	(0.069)	(0.083)
ln(grandfather_wage)*North		0.0736
		(0.058)
North	0.351 **	-0.00136
	(0.243)	(0.226)
Constant	1.293 ***	1.122 ***
	(0.113)	(0.108)
R^2	0.379	0.411
N	1,417	1,417

Robust standard errors in parentheses, clustered at the family level

* p<0.10, ** p<0.05, *** p<0.01

As expected, and in line with the aforementioned studies, the IGE increases when accounting for the grandfathers, from an elasticity of 0.647 to 0.694 for the South, and from 0.546 to 0.608 for the North. There is no indication that the size of this effect differs between the North and the South, however. The fact that also the coefficient on the interaction between the father's wage and the North dummy becomes insignificant is probably due to the selection of rather special families in this sample, as mentioned earlier. Looking only at rather immobile families in both the North and the South, there appears to be no difference in mobility for these families. Still, the coefficient estimated has the expected negative sign.

To sum up, we find evidence for greater social mobility in the North than in the South of England before 1850. What might explain these initial differences? The literature on historical patterns of social mobility is very sparse, and besides, there are no previous attempts to estimate differential rates of mobility between North and South. Answering this question would thus require a detailed study of the cultural norms and social structures of these regions in the early modern period, which is clearly beyond the scope of the present work. Therefore, we provide evidence for the link between mobility and welfare spending, but we leave the answer to the question as to the roots of the difference in the former to future research.

4. Conclusion

We demonstrate that, despite rather constant social mobility for England as a whole, there is plentiful evidence that social mobility, both upwards and downwards, was greater in the North than in the South. Comparing this to the pattern of welfare spending, we provide within country evidence for the Piketty hypothesis that high mobility yields lower willingness to provide welfare spending.

Might the attitudes and social mobility of the North have helped foster the industrial revolution? Might these same factors present challenges in the very different post-industrial Britain of the twenty-first century? Such questions might motivate us to look more into the long run cultural and institutional differences within countries, rather than simply relying on country averages.

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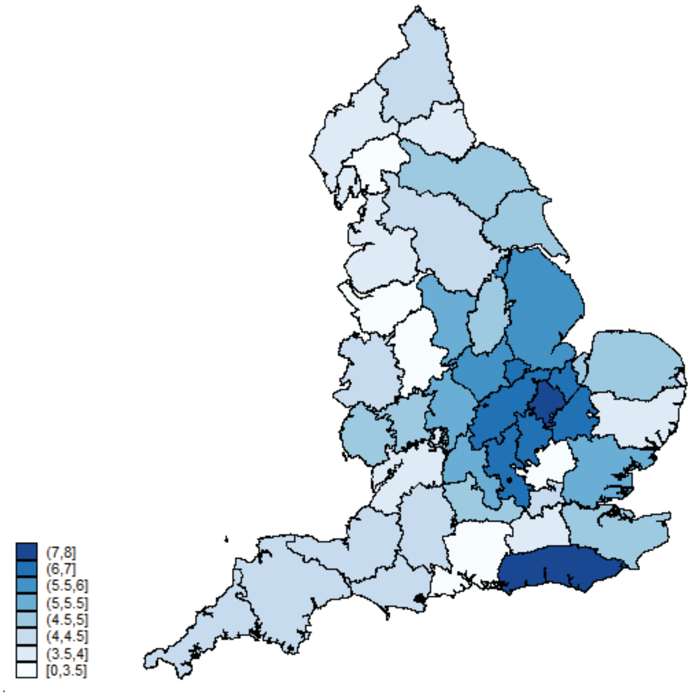
Appendix

Map A1: Relief spending per recipient by county, 1803. Source: Marshall (1834)



Map A2: Number of poor relief recipients by county, 1803. Source: Marshall (1834)

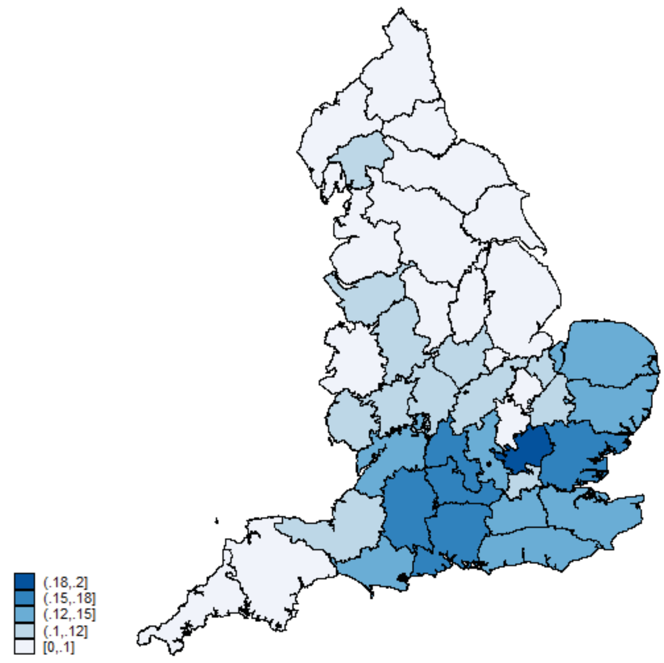


Table A1: Mobility tables, intergenerational occupational mobility in Northern England, 100-year periods

Father's occupation (columns); *Son's occupation* (rows)

pre-1650	*White collar*	*Farmer*	*Skilled / Semiskilled*	*Unskilled*	*Total*
White collar	11	1	20	4	36
Farmer	0	1	3	0	4
Skilled / Semiskilled	16	0	124	26	166
Unskilled	5	2	33	29	69
Total	32	4	180	59	275

Father's occupation (columns); *Son's occupation* (rows)

1650-1749	*White collar*	*Farmer*	*Skilled / Semiskilled*	*Unskilled*	*Total*
White collar	32	0	36	7	75
Farmer	3	1	8	3	15
Skilled / Semiskilled	28	4	291	88	411
Unskilled	12	3	77	85	177
Total	75	8	412	183	678

Father's occupation (columns); *Son's occupation* (rows)

1750-1849	*White collar*	*Farmer*	*Skilled / Semiskilled*	*Unskilled*	*Total*
White collar	20	8	22	10	60
Farmer	0	6	0	2	8
Skilled / Semiskilled	24	8	314	121	467
Unskilled	12	7	84	99	202
Total	56	29	420	232	737

Table A2: Mobility tables, intergenerational occupational mobility in Southern England, 100-year periods

Father's occupation

pre-1650	*White collar*	*Farmer*	*Skilled / Semiskilled*	*Unskilled*	*Total*
White collar	32	5	27	4	68
Farmer	2	46	25	3	76
Skilled / Semiskilled	21	20	213	41	295
Unskilled	8	1	41	31	81
Total	63	72	306	79	520

Son's occupatior

Father's occupation

1650-1749	*White collar*	*Farmer*	*Skilled / Semiskilled*	*Unskilled*	*Total*
White collar	42	5	37	9	93
Farmer	4	48	33	3	88
Skilled / Semiskilled	42	22	540	96	700
Unskilled	11	14	102	144	271
Total	99	89	712	252	1,152

Son's occupatior

Father's occupation

1750-1849	*White collar*	*Farmer*	*Skilled / Semiskilled*	*Unskilled*	*Total*
White collar	48	7	46	23	124
Farmer	4	89	38	14	145
Skilled / Semiskilled	40	35	789	223	1,087
Unskilled	13	30	239	719	1,001
Total	105	161	1,112	979	2,357

Son's occupatior

Table A3: Components of d(North,I), d(South,I) and d(South,North), pre-1650

pre-1650 Contrast	d^i(North,I)	Odds Ratio	d^i(South,I)	Odds Ratio	d^i(South,North)	Pct. Of Total
[(US)/(UW)]/[(WS)/(WW)]	2.99 **	4.47	5.50 ***	15.62	2.50 ***	38.7
[(SS)/(SW)]/[(WS)/(WW)]	2.90 ***	4.26	4.97 ***	12.02	2.07 ***	26.5
[(UU)/(UW)]/[(WU)/(WW)]	5.54 ***	14.30	6.87 ***	41.00	1.33 ***	10.9
[(US)/(UU)]/[(WS)/(WU)]	2.55 **	0.28	1.37	0.50	1.17 ***	8.5
[(SS)/(SU)]/[(WS)/(WU)]	0.32	1.17	1.37	1.98	1.04 ***	6.7
[(SU)/(SW)]/[(WU)/(WW)]	2.58 **	3.63	3.61 ***	6.07	1.03 ***	6.6
[(SS)/(SW)]/[(US)/(UW)]	0.95	0.95	0.52	0.77	0.43 ***	1.1
[(SU)/(SW)]/[(UU)/(UW)]	2.96 ***	0.23	3.26 ***	0.20	0.30 ***	0.6
[(SS)/(SU)]/[(US)/(UU)]	2.87 ***	4.19	2.74 ***	3.93	0.13 ***	0.1

Table A4: Components of d(North,I), d(South,I) and d(South,North), 1650-1749

1650-1749 Contrast	d^i(North,I)	Odds Ratio	d^i(South,I)	Odds Ratio	d^i(South,North)	Pct. Of Total
[(US)/(UU)]/[(WS)/(WU)]	1.63 **	0.44	3.49 ***	0.17	1.87 ***	27.7
[(SS)/(SU)]/[(US)/(UU)]	2.59 ***	3.65	4.14 ***	7.94	1.56 ***	19.3
[(SS)/(SW)]/[(US)/(UW)]	0.88	0.64	0.63	1.37	1.51 ***	18.1
[(UU)/(UW)]/[(WU)/(WW)]	6.96 ***	32.38	8.23 ***	61.09	1.27 ***	12.8
[(SU)/(SW)]/[(WU)/(WW)]	3.48 ***	5.70	4.71 ***	10.53	1.23 ***	12.0
[(SS)/(SW)]/[(WS)/(WW)]	4.45 ***	9.24	5.36 ***	14.59	0.92 ***	6.7
[(US)/(UW)]/[(WS)/(WW)]	5.33 ***	14.37	4.73 ***	10.67	0.60 ***	2.9
[(SS)/(SU)]/[(WS)/(WU)]	0.96	1.62	0.65	1.39	0.31 ***	0.8
[(SU)/(SW)]/[(UU)/(UW)]	3.47 ***	0.18	3.52 ***	0.17	0.04 ***	0.0

Table A5: Components of d(North,I), d(South,I) and d(South,North), 1750-1849

1750-1849 Contrast	d^i(North,I)	Odds Ratio	d^i(South,I)	Odds Ratio	d^i(South,North)	Pct. Of Total
[(UU)/(UW)]/[(WU)/(WW)]	5.61 ***	16.50	9.50 ***	115.42	3.89 ***	33.4
[(US)/(UU)]/[(WS)/(WU)]	0.99	0.61	4.59 ***	0.10	3.60 ***	28.6
[(SS)/(SU)]/[(US)/(UU)]	2.24 ***	3.06	4.73 ***	10.64	2.49 ***	13.7
[(SU)/(SW)]/[(WU)/(WW)]	3.70 ***	6.36	5.91 ***	19.18	2.21 ***	10.8
[(SU)/(SW)]/[(UU)/(UW)]	1.91 **	0.39	3.59 ***	0.17	1.68 ***	6.2
[(SS)/(SU)]/[(WS)/(WU)]	1.25	1.87	0.14	1.07	1.11 ***	2.7
[(SS)/(SW)]/[(WS)/(WW)]	4.95 ***	11.89	6.05 ***	20.58	1.10 ***	2.7
[(SS)/(SW)]/[(US)/(UW)]	0.33	1.18	1.14 **	1.77	0.81 ***	1.4
[(US)/(UW)]/[(WS)/(WW)]	4.62 ***	10.08	4.91 ***	11.63	0.29 ***	0.2

Table A6: Link from HISCLASS to Williamson wage groups

We have coded all the occupations in the dataset according to the HISCO classification scheme. HISCO, the historical version of the ISCO scheme, gives a code to each occupation based on the duties and tasks performed in the occupation. These are then grouped together into different 'social classes' according to the degree of supervision exercised and whether the occupation was manual or non-manual. This scheme is called HISCLASS and gives a total of 12 'social classes', with class 12 being the lowest and class 1 the highest. For more details on HISCO and HISCLASS see also van Leeuwen, Maas, Miles and Edvinsson (2002) and van Leeuwen and Maas (2011).

Whenever the specific occupation / HISCO code in our data is not available in one of Williamson's wage groups we assign an average of one or several, similar wage groups to the occupation according to the HISCLASS it is in. We do this according to the following scheme:

HISCLASS		average of wage groups
1		1H
2		1H,7H,8H,10H,11H,12H
3	non-manual	1H
4		5L
5		9H
6,7,8		2H,3H,4H,6H
9	manual	2L
10,11,12		1L

Chapter 4

Does Welfare Spending Crowd Out Charitable Activity? Evidence from Historical England under the Poor Laws

Nina Boberg-Fazlić and Paul Sharp

Does Welfare Spending Crowd Out Charitable Activity? Evidence from Historical England under the Poor Laws*

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Abstract

This paper examines the relationship between government spending and charitable activity. We present a novel way of testing the 'crowding out hypothesis', making use of the fact that welfare provision under the Old Poor Laws was decided on the parish level, thus giving the heterogeneity we need to test for the impact of different levels of welfare support within a single country. Using data on poor relief spending combined with data on charitable incomes by county for two years before and after 1800, we find a positive relationship: areas with more public provision also enjoyed higher levels of charitable income. These results are confirmed when instrumenting for Poor Law spending using the distance to London and historical migration to London, as well as when looking at first differences.

JEL classification: H5, I3, N3
Keywords: Charity, crowding out hypothesis, England, Poor Laws

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1 Introduction

A long-running debate in the economics literature has been on the hypothesis of a 'crowding out effect', whereby government spending crowds out private voluntary work and charitable giving. The idea is that taxpayers feel that they are already contributing through their taxes, and thus do not contribute as much privately. To illustrate this idea, a comparison is often made between the United States and Europe, where the former famously has a smaller government and considerably more charitable giving. The crowding out hypothesis has important policy implications in terms of determining the extent of the welfare state. On occasion the idea of crowding out has also caught the imagination of politicians, most famously perhaps as part of the flagship policy of the British Conservative Party in the 2010 general election: the so-called 'big society'. If crowding out holds, spending cuts could be justified by the notion that the private sector will take over. Crowding out makes intuitive sense if people are only concerned with the total level of welfare provided. However, many other factors might play a role in the decision to donate privately and, in fact, the empirical literature on this is rather inconclusive. Some studies find evidence of no effect, others even of 'crowding in'. In the present work, we provide a simple test of the crowding out hypothesis using historical data, which we believe to be particularly suited to analyzing this issue.

The data we have are from the turn of the nineteenth century. The system of welfare provision at the time was the so-called 'Poor Laws', described as 'a welfare state in miniature' by Blaug (1964). These were implemented with a desire to improve society, and under the belief that a better and healthier society would be both more productive and useful for the military (Brundage, 1998). By 1700 poor relief was universal, but, although all poor were guaranteed relief, exactly how much was offered and who was eligible was decided by the individual parish - and it is this which gives the within country heterogeneity which allows us to test the crowding out hypothesis. Data are available both on welfare spending and charitable incomes on the county level thanks to reports commissioned by the British Parliament for years around the turn of the nineteenth century. At this time Poor Law spending was increasing rapidly, from 1.0% of GDP in 1748-50 to 2.7% of GDP in 1818-20 (Lindert, 1998). In per capita terms real relief expenditures for England and Wales increased by 1.12% during the period 1783/5-1803 and by 1.38% during the period 1803-1818/20 (Boyer, 1990). This increase occurred despite there being no changes in the laws regulating relief during this period and led to concerns among contemporary commentators and economists such as Malthus (1798) and Ricardo (1821). Edmund Burke expressed the belief that mandatory contributions through the poor rate would crowd out voluntary giving, thereby undermining social virtue (Brundage, 1998). Malthus famously believed that the increase in spending was due to a disincentive effect of poor relief. By providing incentives not to work and to marry early and thereby have more children that could not be afforded,[1] he stated that the Poor Laws 'create the poor which they maintain' (Malthus, 1798). Concerns were also raised about the administration of the Poor Laws as well as the administration of charitable trusts,

[1] For this period, incorrectly as it turns out: see Møller and Sharp (2013).

and thus the Gilbert Act of 1787 created Poor Law Unions and required statistics to be produced about Poor Law spending and charities, and in 1818 the Charity Commission was established in order to provide proper supervision of charities by the government. Reform of the Poor Laws eventually came with the famous Poor Law Amendment Act of 1834 (the 'New Poor Law'), which greatly reduced expenditure, and which many at the time saw as an example of 'applied Malthusianism' (Brundage, 1998).

The upshot of this historical debate is that we have rather good and detailed data on poor relief spending and the income of charitable trusts for the years preceding the reform. Moreover, since the Poor Laws were administered on the local level, we have variation in welfare spending within England, thus avoiding the obvious pitfalls of looking for evidence for crowding out across countries, which would be necessary today, since welfare expenditures are now administrated centrally at the national level. Thus, the historical setting of the Poor Laws in England gives us the opportunity to test the crowding out hypothesis at the macro level but within one country.

2 Literature review

The theoretical foundation of crowding out is based on the traditional public good model of charitable giving. Agents derive utility from a public good, in this case welfare provision or the well-being of others, and regard their own and other agents' contributions to the public good as perfect substitutes. This means the agent is purely altruistic, in that he is only concerned with the total amount of welfare provided, such that the model predicts perfect (i.e. dollar-for-dollar) crowding out between government provision of welfare and private charity (see for example Warr 1982 or Bergstrom, Roberts and Varian 1986). However, since the prediction of perfect crowding out is not empirically supported and the predicted level of giving is unrealistically low, the model has been extended in several directions. One of these extensions is the impure altruist model developed by Andreoni (1989 and 1990).[2] Here, agents are said to be impurely altruistic as they derive utility from their own contribution to charity as well as the total level of welfare. One explanation could be that agents not only care about the well-being of others but also wish to donate to charities 'to do the right thing' or 'to do good'. This leads to a situation where crowding out is less than perfect, i.e. less than one-for-one. Another explanation for less than perfect crowding out is, for example, a signalling effect of wealth from charitable giving, as in Glazer and Konrad (1996). However, the predicted relation is still negative.

There exists a rather large empirical literature testing the theoretically predicted crowding out effects between public and private welfare spending. These can be classified into three different strands: first, one using micro level data on specific charities, second, one

[2] Earlier work in the same direction includes, for example, Feldstein 1980, Cornes and Sandler 1984 or Steinberg 1987.

taking an experimental approach, and third, cross-country studies. The first makes use of micro data from specific charities or household expenditures, and estimates the effect of a larger provision of government funds on private donations to that charity. In general, imperfect crowding out is supported where the crowding out effect is usually rather small. Both Gruber and Hungerman (2007), using public welfare expansion during the Great Depression, and Abrams and Schmitz (1984), using tax return data from 1948-1972 across U.S. states, for example, estimate a crowding out coefficient of only 0.3 percent.[3] Also Steinberg (1985) finds small crowding out effects of 0.6 percent using the UK Family Expenditure Survey combined with government expenditure on social services. Khanna and Sandler (2000) find evidence of crowding in, i.e. a positive relation, of public funds on private donations using data on 159 fund-raising charities in the UK. Roberts (1984) on the other hand argues for complete crowding out during the Great Depression due to an overprovision of public welfare which reduced private charity to zero. Acknowledging the fact that private donations still existed, he argues that almost none of these went to the poor. The approach taken in these studies differs from our approach taken here, however, since we are measuring the effect of the public provision of welfare and not the public funds devoted to private charities. Although this literature clearly tests the crowding out hypothesis in a setting where public and private funds are used to support the same cause, this kind of crowding out might not be what we are actually interested in, especially when thinking about differences in the extent of the welfare state across countries. Also, it is questionable how informed donors really are about the size of government grants to specific charities.

The second strand of the literature, using experiments, finds larger crowding out effects. The application of forced transfers in the dictator game has been found to lead to a crowding out of voluntary transfers of around 70 percent: see for example Chan, Godby, Mestelman and Muller (2002) or Bolton and Katok (1998). Although interesting and informative, crowding out coefficients of this size have not been observed outside the laboratory setting.

More closely related to our approach is the third strand of the literature, which estimates crowding out on a cross-country basis. Several papers have estimated the effect of the extent of the welfare state on voluntary activity. Although the crowding out theory would suggest that a larger welfare state would induce people to volunteer less, since the state already provides the service, this finds little empirical support. Salamon and Sokolowski (2001) find crowding in between social spending and the level of volunteering and no significant relationship between the level of government support for charity and volunteering, based on an analysis of OECD countries. Also Kriinen and Lehtonen (2006) find that social engaging is in fact higher in more developed welfare states. Van Oorschot and Arts (2005) find a similar result looking at European countries only: both when considering the welfare regime type (as defined by Esping-Andersen, 1990) as well as welfare effort (the amount of social spending), crowding in rather than crowding out is supported. Bielefeld, Rooney and Steinfeld (2005), using micro data from the US, include state-level controls such as total state expenditure on

[3] Other examples include Abrams and Schitz (1978), Kingma (1989) and Ferris and West (2003).

welfare in a study on the determinants of charitable giving. They find no clear evidence for crowding out but their results rather suggest crowding in, i.e. private donations to charity are higher in states with higher total welfare expenditure.

Thus, although theory seems to predict a negative crowding out coefficient, the empirical literature is rather inconclusive. It is generally accepted that crowding out is not perfect, i.e. we would expect a negative coefficient of numerically less than minus one. However, especially cross-national studies often do not support this prior and point more towards a positive relationship between public and private welfare provision. Also, there seems to be a gap between the theoretical and the empirical literature, where the theory is not able to capture the case of no significant relation or of crowding in which is often found empirically. What could explain a positive relationship? One possible explanation is of course always product differentiation, i.e. that public and private welfare provision are used for different purposes. From our discussion of this issue in the next section and the evidence from previous studies, discussed above, it seems that this cannot explain the lack of evidence for crowding out alone. Another potential explanation would be that the welfare state regime one lives in reflects a certain welfare culture or a culture of caring for others and thereby has a positive effect on the decision to donate privately. One could imagine that a more developed welfare state helps people to believe in the need for and the desirability of providing for others, such that the agent would also want to give privately. This could of course also work through social pressure where one feels obliged to contribute privately, rather than a purely voluntary decision to donate. Supportive of this argument would be welfare regime theory, which suggests that the welfare regime type shapes the political and ideological beliefs of citizens. Jæger (2009) provides empirical support based on social survey data from 15 countries showing that the welfare regime type has an effect on the support for redistribution among citizens. Bielefeld, Rooney and Steinfeld (2005), in their study on US micro data including state-level controls, also try to capture cultural effects by including voting patterns and a Caring Index. Especially the latter has a significant positive effect on the individual probability of making a donation as well as on the size of that donation.

In relation to the historical setting we are concerned with here, this notion is for example supported by Ben-Amos (2011), presenting evidence that the parish was actively promoting private giving alongside the Poor Law provision. Also Hindle (2004), although for an earlier period, notes the social pressure on the gentry and even the less wealthy to care for the poor of the parish over and above paying the tax financing poor relief. He describes this social pressure as an expectation to give food, cash and bequests to those in need. Within the idea of a culture of giving there could still be product differentiation as giving to private charity allows for giving to more specific purposes, such that agents concerned with a particular purpose would wish to give to that purpose besides the compulsory contribution through the tax rate. However, if people just always wished to donate some given amount to specific purposes, we cannot explain a potential positive relation between public and private welfare provision without the presence of a spill-over effect from government provision. A culture of giving could also be interpreted as a signalling effect, if the government does not deem it necessary to help the poor one might be inclined to believe that there is also no need to do so privately. With a higher tax rate, on the other hand, the government might signal it to be both necessary and correct to help the poor.

Based on this idea one could imagine agents have the following utility function

$$U_i = U_i(x_i, Y, \phi(\tau)g_i) \tag{1}$$

which is an extension of the utility function used in models of pure or impure altruism as, for example given by Andreoni (1990), with a cultural factor reflected by the term $\phi(\tau)$. Here, x_i is personal consumption of a composite good, Y is total welfare (government + private charity) and g_i is private giving to charity by agent i. If the function ϕ is increasing in the tax rate, τ, the tax regime the agent lives in promotes a culture of giving, which has a positive effect on the agent's valuation of donations to private charity.

3 Historical Background

In 1601 the Act for the Relief of the Poor established that every parish had to implement a system of assistance to paupers. Although the Act was to be implemented nationwide it was the responsibility of the individual parish to establish the system and determine eligibility for relief and the size of payments. This meant that relief was financed locally by a property tax, called the poor rate, on the value of land, above a certain minimum level. Ratepayers were occupiers of land, i.e. if land was rented out the person renting the land rather than the owner would pay the rate. Formalities of the relief system were administered by the 'vestry' which either comprised all ratepayers of the parish or only selected ones, elected by the other ratepayers. The vestry would then set the rate to be paid and appoint an administrator (Boyer, 1990). Whereas the Old Poor Laws were established by the Act of 1601 it took several decades for all parishes to actually implement the system. We do not know exactly when each parish implemented a poor relief system, but Slack (1990) estimates that around one third of the parishes had relief systems in place by 1660 and that it was universally implemented by 1700. Relief was only given in the home parish, meaning that migrants had no right to relief.

During the course of the Old Poor Laws several amendments were made, mainly trying to restrict the use of outdoor relief, i.e. relief paid to people living at home and not required to stay in the workhouse. However, keeping a workhouse was expensive and thus not viable for many of the smaller parishes. Gilbert's Act of 1782 allowed parishes to form Poor Law unions to establish a workhouse together, which should mainly take care of the poor who were not able to work. Those able to work, should either be put to work or relieved at home if that was cheaper for the parish. Additionally, the Act required each parish to produce statistics on Poor Law expenditures as well as on charitable activities in the parish. The idea was that a sensible reform of the Poor Laws was only possible on the foundation of reliable statistics. These numbers were then collected by the Royal Commissions and reports were produced which form the basis of our analysis.

In order to provide a valid test for the crowding out hypothesis, we need to know more about what poor relief included and whether this was comparable to what charity was given for. In the original reports only county totals are given, and we thus have to turn to other sources for more details. King (2000) examines poor relief in several parishes across England on the basis of individual applications to the parish administrator of poor relief. From these it is possible to divide relief expenditures into three broad categories: regular payments (mainly pensions), irregular payments in cash and irregular payments in kind. In the years 1790 and 1820, regular payments constituted around half of total spending. Approximately equal shares of the other half went to irregular payments in cash or in kind. The largest share of irregular cash payments were given without a specific purpose and to medical assistance or rents. Most in kind payments covered clothes, food or medical assistance. But poor relief would also cover other items such as apprenticeships for the children of poor families, tools and fuel. Hindle (2004) finds around the same proportions of regular and irregular payments for several individual parishes as King, though looking at the period prior to 1770. He describes irregular payments as going mainly to medical care, food, clothes, fuel and rent. Slack (1990) also finds that cash relief was most common.

Parallel to the history of poor relief there is a similar story for private charities. The reports from which we are taking the data include all charitable trusts for the 'use and benefit of poor persons'. In 1601 the Statute of Charitable Uses Act defined the purpose of charitable trusts as:

> *'relief of aged, impotent, and poor people; some for maintenance of sick and maimed soldiers and mariners; schools of learning; free schools and scholars in universities; some for repair of bridges, ports, havens, causeways, churches, sea banks, and highways; some for education and preferment of orphans; some for or towards relief, stock, or maintenance of houses of correction; some marriages of poor maids; some for support, aid, and help of young tradesmen, handicraftsmen and persons decayed; and other for relief or redemption or prisoners or captives; and for aid or ease of any poor inhabitants concerning payments of fifteens, setting out of soldiers, and other taxes.'*

Donations were often given in the form of bequests but also throughout life. It was popular to subscribe to charities, and although there were large aristocratic donors, charitable giving became increasingly popular among the middle classes during the eighteenth century (Owen, 1964).

In order to get a better picture of what the income of charitable trusts was used for, we can look at the report of 1815. Here, every charity is listed individually and often it is possible to see the purpose from the name of the particular charity. A large share of the charities have a general purpose, with names such as 'Park's charity to the poor' or simply 'Distributed to the poor'. Many others have more specific purposes such as 'paying rents for poor tenants', 'annuity to six poor widows', 'Forrester's charity, distributed to poor widows and widowers', or 'Distributed in clothes to three poor men'. All of these are very reminiscent of the items paid for by poor relief. Moreover, Hindle (2004) notes that donations were often given conditionally to poor who had 'morally acceptable' behavior, i.e. were not drinking, swearing, criminal, and were conditional on the person being from the parish, i.e. they did not give to migrants. This reflected developments in poor relief expenditure, as the concept of the 'deserving poor' became very important in the discussion of relief during the eighteenth century. However, charities also include schools and hospitals. Hospitals are not such a large share but the schools are rather numerous, which could be a problem for our analysis if this means that poor relief and charity were simply spent on different things, making the idea of crowding out less obvious. We discuss this more below, and take account of it in our empirical analysis.

To sum up, both poor relief and charity were given to a variety of people with different needs but were largely used for the same purposes. The setting of the Old Poor Laws thus gives us the opportunity to test the crowding out hypothesis at the macro level but within one country, allowing us to overcome what has been the main objection to previous attempts at testing.

4 An Empirical Test of the Crowding Out Hypothesis

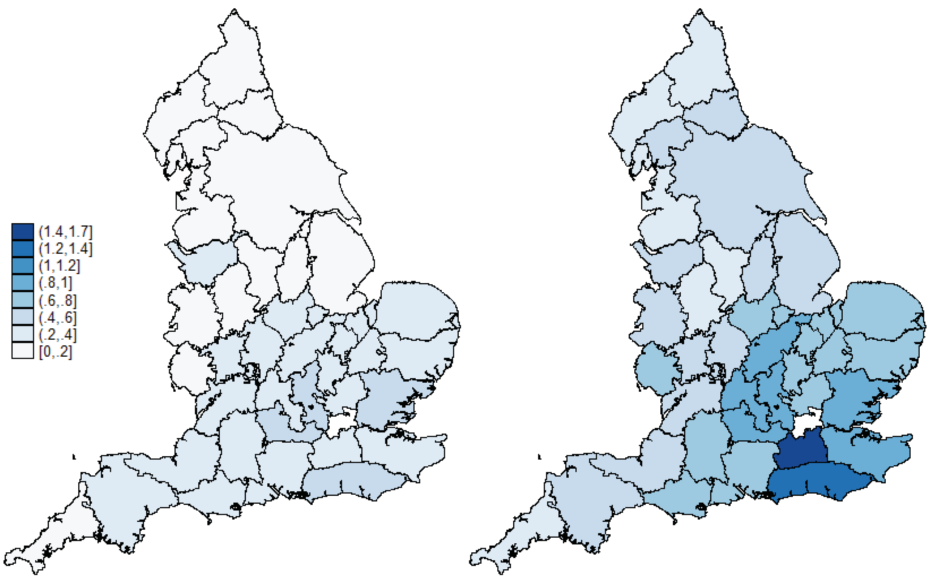
4.1 The data

The data on poor relief in the years 1785 and 1815 is taken from Marshall (1834). For the year 1785 this is an average of the three preceding years ending Easter 1785. The data on charity is taken from the *Report from the Committee on Charitable Donations* in the years 1787 and 1815, which gives the income of private charities in the respective years ending Easter (5th of April in 1815 and the report of 1787 was finished on 23rd of May).[4] Charitable income includes rents and profits of land as well as dividends received from stocks owned by the charity. All figures are given by county.[5] As mentioned earlier, charities also include schools which we would not want to be driving our results. Details on the individual

[4]Greg Clark has also made use of data on charities but from the later Charity Commission reports from 1818. We cannot use these because they do not cover the whole country as a snapshot from a single year, but rather report different counties each year. See Clark (1996, 1998a, 1998b, and 2002).

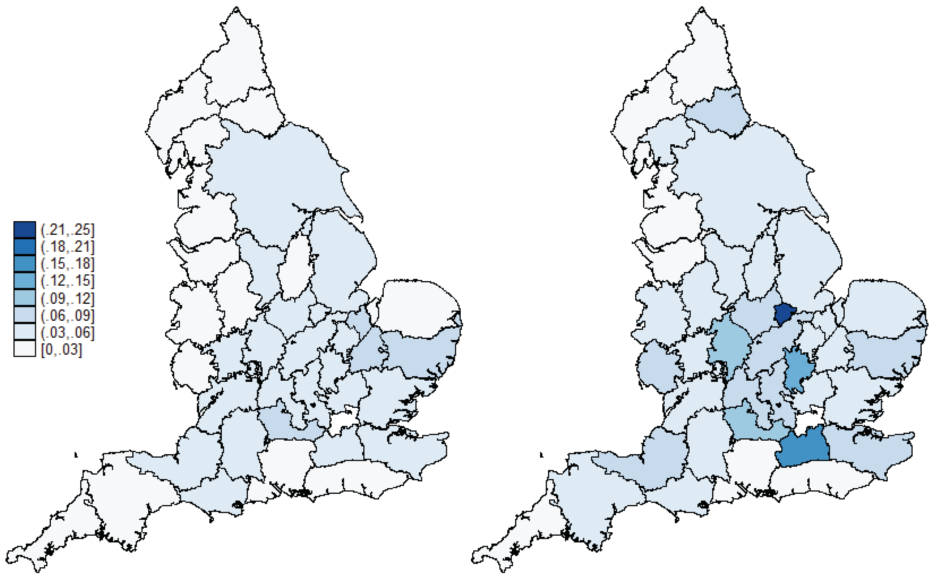
[5]In the year 1815, some large royal hospitals, situated in Greenwich and in Southwark are included in the figures for Kent and Surrey, respectively. They overstate the numbers for these two counties, and we therefore subtract the income of the *Royal hospital*, the *Chest at Greenwich for the relief of wounded seamen*, the *Royal hospital for the education of seamen's children* and the *Royal naval asylum* from Kent and *Guy's hospital* and *St. Thomas' hospital* from Surrey.

charities are only available in the 1815 report but not in 1787. We thus remove all schools from the 1815 data and rerun the analysis. Using the data from 1815 only gives the same qualitative results as those below, as does assuming the same share of schools in charitable income in 1787 and rerunning the analysis for both years. As including the schools does not alter our results, the analysis shown below includes schools, such that we do not have to make additional assumptions about the share of schools in 1787. We use per capita figures throughout the analysis for both poor relief and charitable income, where population figures for 1791 are taken from Wrigley (2007) and for 1811 from Mitchell (1988). Data for London and Middlesex are not available, which leaves us with 38 counties and two observations for each. Figures 1 and 2 below display the data on per capita relief spending and per capita charitable income by county.



(a) 1785 (b) 1815

Figure 1: Per capita poor relief spending



(a) 1787 (b) 1815

Figure 2: Per capita charitable income

We can clearly see the large increase in poor relief spending between 1785 and 1815, which led to discussions and concerns about assistance to the poor. We also see that there is substantial geographic variation in both poor relief and charity. The model to be estimated is then given by the following

$$ln(pcCharity_{it}) = \alpha + \beta\, ln(pcRelief_{it}) + \delta t + X_i'\gamma + \epsilon_{it} \quad (2)$$

where both charity and relief are given in logs of pounds per capita for county i in period $t = 1785/87, 1815$. We include a time dummy for the year 1815 and a vector of exogenous controls X_i'. ϵ_{it} is the error term, clustered at the county level. The coefficient of interest is β.

4.2 Determinants of poor relief and charitable giving

Based on a large literature survey, Bekkers and Wiepking (2011) and Wiepking and Bekkers (2012) identify income as the most important determinant of charitable giving. Other factors include religion, education, and wealth.[6] The positive effect of religion on charitable giving is most often found in the context of giving to charities associated with religious causes but not

[6]Other factors considered relevant by Bekkers and Wiepking (2011) include marital status, gender, and the number of children. The importance of marital status is largely due to tax reasons, which is not relevant in our case and besides marriage was the norm. The effect of gender is usually found to be insignificant when controlling for other factors such as education, religion, and income. The number of children also does not seem relevant, since there were no significant regional differences in fertility rates (see Boberg-Fazlic, Sharp and Weisdorf 2011).

to secular charities (see for example Wilhelm, Brown, Rooney and Steinberg, 2008). Since we are only concerned with non-religious charities here, the lack of data availability on religiosity does not seem to pose a big problem. In studies on modern data education is almost always included as a control. Bekkers and Wiepking (2011) identify two mechanisms for how education affects philanthropic behaviour: through cognitive ability and through an income effect. Higher cognitive ability should lead to a higher awareness of the needs of others. This might be very relevant in the modern world where many charities operate on the national or even international level as one would have to be informed about conditions potentially far away. Awareness of need in this context might require a certain level of education. In our setting, however, charity and relief occur at the very local level - the individual parish. The income effect of education is thus more relevant for this study. Overall, controlling for income/wealth seems most compelling. We do this by including a number of geographical controls. These include land quality measuring the suitability for agriculture,[7] since agriculture was still the most important source of income during our period. Furthermore we include a dummy variable for access to the coast. For example Rappaport and Sachs (2003) have shown the importance of coastal access for productivity giving access to trade and extended markets. The same argument can be used for access to navigable rivers (Sokoloff, 1988). We account for this by including length of rivers to county area as a control variable.[8] We also control for coal fields as a share of county area taken from Redmayne (1903). For example Wrigley (1988), Pomeranz (2000) and Allen (2009) have emphasized the role of coal during the industrial revolution. Our period falls within the beginning of the industrial revolution and access to coal is therefore a potentially important determinant of income.

Apart from these general factors influencing charitable giving which might also determine the extent of public welfare, it is often suggested that a division between arable and pastoral farming influenced the level of poor relief spending due to higher seasonality in arable agriculture. One possibility could have been to pay a wage also during the low season, but it was more profitable to spread the off-season costs on other non-labor hiring ratepayers by providing poor relief (Boyer, 1990). Another channel through which this division could influence both poor relief and charitable giving is inequality. Engerman and Sokoloff (2000) argue that inequality is greater in areas more suitable for crops with scale economies, though in the context of Latin American countries. Jewell (1994) makes the similar argument that arable agriculture is more likely to be based on a system of large landowners whereas pastoral farming allows for smaller holdings. To account for these structural differences we therefore include the suitability of the county for arable agriculture, as given by the Food and Agriculture Organization of the United Nations as a control variable.[9]

Another potentially important factor in determining the amount of poor relief spending

[7]Our variable measures the share of county area classified as grade 1 or 2 according to the Agricultural Land Classification given by *www.naturalengland.org.uk* and available for download at *www.magic.gov.uk*. This measure combines an assessment of climate, site and soil.

[8]Available at *http://download.geofabrik.de/osm/europe/great_britain*

[9]'Crop suitability index (class) for low input level rain-fed cereals', i.e. using traditional methods of agriculture, from GAEZ, Global Agro-Ecological Zones, at the Food and Agriculture Organization of the United Nations.

and charitable income, specific to our setting, is that of enclosure. There were two waves of enclosure in England, one in the sixteenth century and one in the eighteenth and nineteenth centuries. During the first wave land was mostly enclosed by voluntary agreement, whereas during the second wave most enclosure was through Acts of Parliament. Enclosure not only varied through time but also by region. Chapman (1987) shows that enclosure of arable land spread in circles, starting around 1792 in the Midlands. On the other hand, counties like Kent and Essex, for example, never really had open field farming to be enclosed. Increased poverty among laborers and smallholders is often mentioned as a consequence of enclosure, especially at the time. Arthur Young described the effects of enclosures on labourers in the General Report on Enclosures (1808), based on interviews with labourers, farmers and clergymen in 69 parishes who were enclosed between 1760 and 1800, concluding that the majority of labourers were worse off after enclosure. It has therefore been suggested that enclosure increased the need for welfare spending (see for example Turner, 1984). Enclosing a piece of land was not without cost, which implies that there were incentives to enclose more valuable land. The effect of enclosure might therefore be already captured in our control of agricultural quality of land. Additionally, the period we are looking at was one of exceptionally high wheat prices due to the French wars. Land suitable for growing wheat was therefore especially attractive for enclosure (see also Boyer, 1990). We therefore also include the more specific control of land suitability for growing wheat.[10]

Summary statistics and a correlation matrix for the variables described above and additional variables used in later analyses as well as a scatter plot of per capita relief spending and per capita charitable income can be found in the appendix.

4.3 OLS results

We first estimate equation (2) as a pooled OLS model with standard errors clustered at the county level. All regressions include regional dummies to account for possible fixed effects.[11] Results are given in Table 1 below.

[10]Here we use the 'Crop suitability index (class) for low input level wheat', i.e. using traditional methods of agriculture, from GAEZ, Global Agro-Ecological Zones, at the Food and Agriculture Organization of the United Nations.

[11]The regions are based on the NUTS2 regions defined by Eurostat and include: North West (Cumberland, Westmorland, Lancashire, and Cheshire), North East (Northumberland, Durham, Yorkshire), West Midlands (Shropshire, Staffordshire, Herefordshire, Worcestershire, Warwickshire, East Midlands (Derbyshire, Nottinghamshire, Lincolnshire, Leicestershire, Rutland, Northamptonshire), East (Huntingdonshire, Cambridgeshire, Norfolk, Suffolk, Bedfordshire, Hertfordshire, Essex), South West (Gloucestershire, Somerset, Wiltshire, Dorset, Devon, Cornwall), and South East (Oxfordshire, Buckinghamshire, Berkshire, Hampshire, Surrey, Kent, Sussex).

Table 1: Pooled OLS regressions

	(1) ln(pcCharity)	(2) ln(pcCharity)	(3) ln(pcCharity)	(4) ln(pcCharity)	(5) ln(pcCharity)
ln(pcRelief)	1.260***	1.224***	1.233***	1.229***	1.267***
	(0.368)	(0.434)	(0.402)	(0.404)	(0.399)
agr. quality		0.762			0.677
		(0.489)			(0.496)
grain suitability			1.298		
			(0.877)		
wheat suitability				1.306	1.231
				(0.894)	(0.859)
coast access		-0.325*	-0.336*	-0.337*	-0.345*
		(0.175)	(0.171)	(0.172)	(0.179)
rivershare		2.099	0.541	0.508	0.752
		(2.016)	(2.249)	(2.251)	(2.313)
share_coal		-0.0590	-0.0373	-0.0238	0.215
		(1.013)	(1.006)	(1.010)	(1.022)
ln(area)		-0.0735	-0.0279	-0.0370	-0.0585
		(0.179)	(0.180)	(0.174)	(0.180)
Constant	-1.994***	-2.141***	-2.127***	-2.103***	-2.136***
	(0.489)	(0.527)	(0.495)	(0.495)	(0.502)
Observations	76	76	76	76	76
R^2	0.490	0.559	0.571	0.570	0.581

Robust standard errors in parentheses, clustered at the county level
All regressions include time and regional fixed effects
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Per capita poor relief spending turns out to have a significant positive relationship with per capita charity. Column (1) in Table 1 shows the most parsimonious specification without control variables, only time and regional fixed effects are included. As mentioned above, especially income is an important confounding variable of relief and charity, which we have to control for. Columns (2)-(4) therefore include the geographical control variables described above. As the measure for agricultural quality, grain suitability, and wheat suitability are likely to be correlated, we include these one at a time (columns (2) and (3) and (4)). Since especially grain and wheat suitability seem to be correlated (the coefficient of grain suitability drops to -0.09 when including all three variables), we only include agricultural quality and wheat suitability in the rest of the specifications, as shown in column (5). Our observations include counties of very different sizes, and one way we account for this is by including the area of the county (in logarithms) as a control variable. Another possibility is to exclude the smallest counties as we would not want these to drive our results. Results excluding the five smallest counties, by population in 1811, can be found in the appendix. Following Peri (2012), we also show results when excluding the counties directly bordering London. One might worry that there was a special culture of charity in London, maybe due to its exceptionally high death rates, spilling over to the surrounding counties and thereby driving our results.[12] However, this does not seem to be the case as the estimated coefficients hardly change when excluding the counties directly bordering London. Overall it is evident that the coefficient of interest, indicating a positive elasticity of around 1.2, is remarkably stable across specifications. The partial correlations plot, shown in Figure 3 below, indicates the strong positive relationship. Cornwall appears as a potential outlier, but excluding the county does not change the fact that we find a significant, positive relationship.

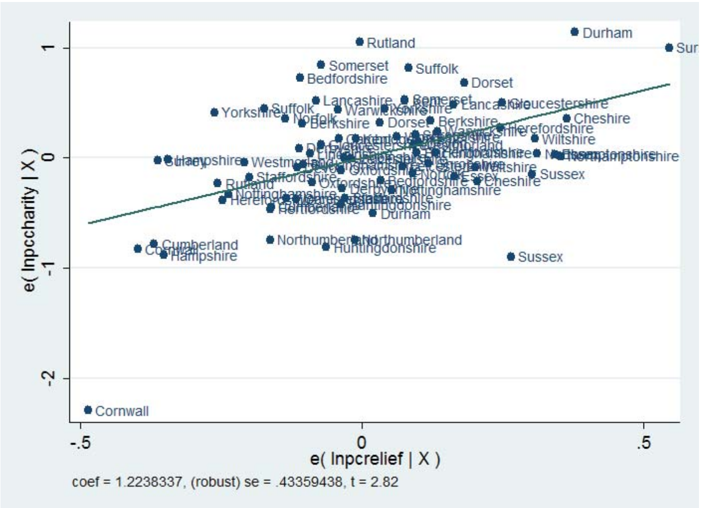


Figure 3: Partial correlation between per capita relief spending and per capita charitable income

However, causality here could go either way: we want to identify the crowding out effect of public on private welfare provision, but of course it has to be expected that there is also an effect of private on public provision. Especially, in our setting where the economic elite of the parish decided on the poor rate themselves, it should be expected that the OLS coefficient is biased downwards as crowding out could go either way. Higher public provision could lead to lower donations to private charity and higher private donations could lead to a preference for lower public provision. The crowding in effect, potentially stemming from a culture of giving promoted by the government as described earlier, is expected only to be present from public to private welfare provision, however. In addition, the OLS coefficient might be biased due to omitted variables. We therefore turn to an IV approach in the next section.

4.4 IV results

Boyer (1990) suggests that poor relief was granted as a means to mitigate the gains from migration. In order to keep laborers in the parish and prevent them from migrating to urban centers with non-seasonal employment opportunities, poor relief would have to be granted

[12] This may be more relevant in the next section where we use distance to London as an instrument for poor relief. For consistency we also show the results excluding counties bordering London for OLS.

during the low season. Under the Old Poor Laws, London was the most important and attractive urban centre for migrants. In 1801 London had a population of 959,000 which increased to 1,139,000 in 1811, despite death rates exceeding birth rates. Compared to that the second biggest city in 1801 was Manchester with 75,000 inhabitants increasing to a population of 89,000 in 1811 (Mitchell, 1992). Although Manchester had a similar growth rate to London during the period, the absolute number of migrants attracted was still far from that of London. As Clark (1979) notes, 'London was by far the most powerful urban influence on regional patterns of migration in late 17th and early 18th century.' (p.77). Although this position was somewhat weakened with industrialization in the northern counties, the pull of London continued to be strong, attracting migrants from all over England and especially from nearby counties (Nicholas and Shergold, 1987). Owen (1964) describes London as 'the magnet which attracted immigrants from all over the Kingdom' (p. 38) during the eighteenth century such that the city saw great rates of expansion despite very high death rates. Also Wareing (1980) and Friedlander and Roshier (1966) note that London continued its demographic growth mainly due to migration during the eighteenth and nineteenth centuries, respectively. We take up this idea, that poor relief was a given as a means to offset gains from migration, by using the exogenous parts of the propensity to migrate to instrument for poor relief. As London clearly was the main destination for migration during our period, we concentrate on the propensity to migrate to London.

The factors influencing migration rates can be broadly categorized as the expected gains and the costs of migration. As the gains of migration are basically determined by income, which clearly also is a determinant of poor relief and charitable giving, we focus on the cost of migration in our identification strategy. Motivated by the gravity model, the cost of migration is usually measured by the geographical distance (see e.g. Peri, 2012). The geographical distance can be interpreted as capturing the actual travel cost but also the psychological cost of leaving the family and the cost of obtaining information (Nicholas and Shergold, 1987). Since distance is clearly exogenous, we use distance to London as an instrument for the amount of poor relief given in a particular county: the closer to London a parish was situated, the lower the cost of migration for laborers. Therefore, the parishes closer to London had to provide higher relief to the poor to keep laborers in the parish. As our instrument is time invariant, we can only use it in a cross-sectional analysis on the levels of relief spending. This leaves a potential problem of county fixed effects which we cannot account for. As above, we therefore include regional dummies in all regressions as well as the control variables described above. It would especially be a problem for our identification strategy if such a confounding factor would violate the exclusion restriction. The distance to London could have a direct effect on charitable income if its effect on poor relief spending was not due to the cost of migration but rather due to some other factor which would increase the need or potential for assistance to the poor in general, most notably the wage of laborers and the wealth of those paying for poor relief and giving to charity. We try to control for income with the geographical controls, but we also have other means to check whether distance to London is correlated with income. First, we use the wealth ranking compiled by Buckatzsch (1950), which is based on property tax returns, thus measuring the wealth of those who are most likely to contribute to poor relief as well as charity. Maps for the ranking in the years 1803 and 1814 (the years closest to our periods) can be found in the appendix. The wealthiest counties are spread throughout the country, with London, sites of industrialization (i.e. Manchester, Liverpool and Birmingham) and Bristol, being an important port, showing the highest wealth. No clear pattern between wealth and proximity to London appears. Furthermore, Hunt (1986) provides wages of agricultural laborers for the periods 1767-1770 and 1794-1795.[13] As agricultural laborers were the most likely to receive welfare, this is more of a measure of need than of potential for giving. Correlating wages with the distance to London shows in fact a negative relation in the first period and no relation in the second period. Thus, if anything, this effect goes in the opposite direction.

One factor reducing the cost of migration is that of pre-existing networks. The idea is that a network of earlier migrants from the same location will make it easier for other migrants to follow as they can more easily obtain information through the existing network. This could include information concerning the migration process, work opportunities, or housing for example. Thereby, migrants are attracted to places where others from the same region have migrated to. There exists an extensive literature on the importance of networks during the migration process. For example, Massey and Espana (1987) applied this concept to Mexican migration to the US and also Munshi (2003) finds positive effects of migrant networks for job search outcomes in this setting. Carrington, Detragiache and Vishwanath (1996) provide a theoretical foundation and find evidence for the importance of networks during the Great Black Migration in the US. Based on these findings another branch of the migration literature uses historical migration rates as an instrument for current migration, initiated by Card (2001). We follow this idea and use the share of migrants from county i to London as a further instrument for poor relief, measuring the network effect of migration. Good historical data on migration is sparse, since birthplace was first recorded in the census of 1851. Thus, we have to rely on a sample of migrants to London to be able to use migration rates from before our period. We use data on apprentices and on indentured servants from Wareing (1980, 1981). We use the apprentice data from 1740-50 and servants recorded during the period 1749-75. Figures are only given on a regional basis, so we distribute the number of migrants to the counties in the region by their respective population shares, using population data from 1761 taken from Wrigley (2007).[14] Although, historical migration is widely used as an instrument for current migration, one could worry that both historical and current migration are determined by deeper determinants, which are constant over time (e.g. Ager and Brueckner (2013) or Boustan (2010)), most notably income. As our measure of migration networks is the share of 'London population' (in this case the total number of apprentices and servants recorded), we only have to be concerned with the relative income of county i to all other counties. This is important as there is no reason to expect that the relative income would have a direct effect on charity, whereas the income level of county i

[13] The figures for Yorkshire are the population weighted average of the East Riding, North Riding and West Riding.

[14] We find this necessary as some regions include counties of very different sizes, such as Rutland and Yorkshire. It is to be expected that the absolute number of migrants depends on the county's population size. We make the assumption that people in the same region have the same likelihood to migrate.

probably will influence the amount of charity given in county i. As described above, both charity and poor relief were given at the very local level, in the parish. If there were any considerations on relative incomes these are then also likely to be at a much more local scale. Most likely even within the parish as charity was often given to particular families or in relation to neighbouring parishes. We therefore use the historical migration share as an exogenous determinant of the propensity to migrate to London and thus as an instrument for the amount of poor relief spending.[15]

We follow Peri (2012) and use the distance to London and migration networks in London as two separate instruments. Column (1) in Table 2 below shows the first stage results for this specification and column (2) the second stage results. All regressions include time and regional fixed effects. Historical migration does not have a significant effect on poor relief beyond the distance to London, indicating that the two measures are correlated. Also, the Kleibergen-Paap test statistic is not above the threshold level of 10, usually used to indicate the strength of an instrument. Nevertheless, the Hansen J test of overidentification does not reject that both instruments are correctly specified as being exogenous. Due to these weaknesses when using both instruments simultaneously, columns (3)-(6) show the results when using them separately. When used individually they are both very significant in the first stage and the Kleibergen-Paap test statistic is above 10. All three specifications give a result very similar to those of the OLS regressions. Per capita poor relief spending has a significant positive effect on per capita charity with an elasticity slightly above 1. Thus, counties with higher public welfare spending also exhibited higher private charitable activity. The estimated 'crowding in' coefficient is slightly larger than with OLS as predicted, although it is not significantly different. As in the OLS specification, robustness checks of excluding the smallest counties and excluding the counties directly bordering London are shown in the appendix.[16] Overall, the results are very stable, somewhat larger in the specifications excluding small counties and counties neighbouring London, however not significantly different from our previous results.

[15] At a later stage we also control for the relative wage of county i to all other counties, which makes no difference to our results.

[16] We also tried a placebo test using the distance to Manchester instead of London as an instrument. As expected distance to Manchester was not significant in the first stage.

Table 2: 2SLS estimates

	(1) 1st stage: distance, migration	(2) 2nd stage: distance, migration	(3) 1st stage: distance	(4) 2nd stage: distance	(5) 1st stage: migration	(6) 2nd stage: migration
ln(LondonDistance)	-0.326*		-0.379***			
	(0.170)		(0.106)			
ln(HistMigrShare)	0.0457				0.220***	
	(0.0938)				(0.0552)	
ln(pcRelief)		1.680**		1.731**		1.383**
		(0.662)		(0.677)		(0.658)
agr. quality	-0.0439	0.761*	-0.0720	0.771*	0.0191	0.701
	(0.188)	(0.457)	(0.189)	(0.457)	(0.159)	(0.465)
wheat suitability	-0.290	1.315*	-0.285	1.325*	-0.285	1.255
	(0.285)	(0.786)	(0.274)	(0.788)	(0.290)	(0.772)
coast access	0.0725	-0.339*	0.0777	-0.339*	0.0221	-0.343**
	(0.0675)	(0.176)	(0.0648)	(0.179)	(0.0852)	(0.162)
rivershare	0.600	0.975	0.585	1.003	0.277	0.815
	(0.884)	(2.256)	(0.872)	(2.270)	(0.985)	(2.196)
share_coal	-1.234***	0.795	-1.176***	0.868	-1.537***	0.378
	(0.299)	(1.147)	(0.258)	(1.152)	(0.243)	(1.201)
ln(area)	-0.0868	-0.0452	-0.0369	-0.0436	-0.276***	-0.0548
	(0.127)	(0.178)	(0.0583)	(0.180)	(0.0809)	(0.168)
Constant	0.558	-1.786***	0.574	-1.742***	0.0171	-2.038***
	(0.436)	(0.655)	(0.412)	(0.676)	(0.221)	(0.608)
Observations	76	76	76	76	76	76
Kleibergen-Paap		7.210		12.86		15.90
Anderson-Rubin (p-value)		0.100		0.0429		0.0317
Hansen J (p-value)		0.430				

Robust standard errors in parentheses, clustered at the county level
All regressions include time and regional fixed effects
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

One might have doubts about the representativeness of the migration data from before our period. Additionally, Angrist and Krueger (2001) suggest that one instrument is preferable to a set of instruments. We therefore conduct a further robustness check using the census data from 1851. Based on the idea of using the supply-push component of migration (see Card 2001), we first determine the exogenously determined propensity to migrate for county i by the following regression

$$ln(MigrShare1851_i) = \alpha + \beta_1 ln(LondonDistance_i) + \beta_2 ln(HistMigrShare_i) + \epsilon_i \quad (3)$$

where the distance to London measures the cost of migration and the historical migration measures the network effect, as before, and ϵ_i is the error term. The estimation results of equation (3) are shown in column (1) of Table 3, below. With an R^2 of 0.854 we are able to explain quite a large share of migration. We then use the fitted values of equation (3) as an instrument for poor relief. Column (2) of Table 3 shows the first stage and column (3) the second stage of the IV estimation. The results are very similar to our previous results.

The instrument is strong, as indicated by the Kleibergen-Paap statistic and the estimated elasticity between relief and charity is around 1.4. As mentioned earlier, one might be concerned that relative income determines the county shares of London migrants. As we are only interested in the exogenous components of migration, we do not include it in equation (3). However, as a robustness check we include the relative wage, based on the data in Hunt (1980) for the period 1767-70, as a control variable. The relative wage is calculated as the wage in county i relative to the average of all other counties, in logarithms. As these wages are from before our period, this measure will also be exogenous to relief spending and charitable income. Column (4) shows the second stage results for a specification including the relative wage as a control variable. The relative wage turns out insignificant and the size of the crowding out coefficient is therefore unchanged.

Table 3: Using 1851 migration data

	(1)	(2)	(3)	(4)
		1st stage:	2nd stage:	2nd stage:
	ln(MigrShare1851)	ln(pcRelief)	ln(pcCharity)	ln(pcCharity)
ln(LondonDistance)	-0.324***			
	(0.102)			
ln(HistMigrShare)	1.015***			
	(0.0848)			
Fitted values (1)		0.196***		
		(0.0483)		
ln(pcRelief)			1.454**	1.434**
			(0.644)	(0.609)
ln(rel. wage)				0.574
				(0.510)
Constant	0.277	0.120	-1.977***	-2.066***
	(0.504)	(0.251)	(0.606)	(0.575)
Geogr. controls	No	Yes	Yes	Yes
Observations	38	76	76	76
R^2	0.854	0.915	0.578	0.584
Kleibergen-Paap			16.53	16.57

Robust standard errors in parentheses, clustered at the county level
All regressions include time and regional fixed effects
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Although we have to be careful with a causal interpretation, as we cannot completely rule out the existence of omitted variables, we have presented evidence for a robust positive relationship between public and private welfare. As discussed earlier, an explanation for the observed pattern could be that public emphasis on support for the poor fosters a 'culture of giving' encouraging the richer parts of society to also contribute more privately. King (2000) posits that differences in poor relief spending were due to different cultures of welfare. Investigating individual applications for relief in different parishes, he finds that northern parishes were in general less willing to provide relief. He also finds that relief was granted later, i.e. after a longer period of distress in the North, and that lower payments were given. Relief payments in the North would only cover approximately one third of subsistence, whereas a subsistence income was provided in the South. Boberg-Fazlic and Sharp (2013) provide evidence that the differences in culture could be rooted in differing historical levels of social mobility. Of course, we cannot measure culture in 1800. The, so far indicative, positive correlation between relief and charity might however be evidence for there being different welfare cultures or cultures of giving across the country, as suggested by the utility function in equation (1).

4.5 First differences

Finally, we look at the changes in charitable income over time. Since our instrument is time-invariant, it is useful to look at differences across our period to eliminate potential county fixed effects and to verify our results. We thus estimate the following model

$$\Delta ln(pcCharity_i) = \delta + \beta \Delta ln(pcRelief_i) + \Delta X_i' \gamma + \Delta \epsilon_i \tag{4}$$

where X_i' now includes a number of time varying controls, discussed below. In line with the previous analysis, we would expect to find higher increases in private charity in those counties which exhibit larger increases in poor relief spending, which the analysis below does indeed demonstrate. Note, however, that we are only performing an OLS analysis here and can therefore not say anything about causality in this case. As mentioned earlier, poor relief expenditures increased sharply after 1750. Several reasons have been put forward. Contemporaries, most prominently Malthus, ascribed this to a disincentive effect of the overly generous Poor Laws and increasing population due to family allowances. Boyer (1990) believes it reflects a decline in employment opportunities for women and children in the cottage industry, as well as the effect of enclosure and a decline in the wages of agricultural laborers. We control for the effects of enclosure by including the difference in the percentage of the county area enclosed in the decade prior to our period. This data is taken from Gonner (1966) and includes enclosure of commons and common field. Additionally, we control for the change in wages of agricultural laborers given by Hunt (1986), and for the change in population density to account for changes in productivity.

Table 4: First difference regression

	(1) Dln(pcCharity)	(2) Dln(pcCharity)	(3) Dln(pcCharity)	(4) Dln(pcCharity)
Dln(pcRelief)	0.986**	1.200**	0.974**	1.188**
	(0.408)	(0.504)	(0.418)	(0.518)
Dln(popdens)	-0.647	-0.333	-0.668	-0.352
	(0.646)	(0.779)	(0.662)	(0.803)
Dln(wage)		-0.414		-0.407
		(0.564)		(0.574)
Denclosure			-0.451	-0.309
			(2.188)	(2.213)
Constant	-0.441	-0.606	-0.423	-0.590
	(0.440)	(0.496)	(0.455)	(0.516)
Observations	38	38	38	38

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Again, we find a positive relation such that counties with larger increases in poor relief also had larger increases in charity. With an elasticity of around 1, the size of the coefficient is in line with our earlier results.

5 Conclusion

We find strong empirical support for a positive relationship between welfare provision and charitable giving using data from the late eighteenth and early nineteenth centuries, at a time when both were expanding, but were subject to increasing criticism, in particular by economists. This mirrors the situation since the end of the Second World War, when the size and scope of government provision has come increasingly under attack. There are certainly many theoretical justifications for this, but we believe that the crowding out hypothesis should not be one of them. On the contrary, there even seems to be evidence that government can set an example for private donors.

Apart from the empirical test given above, what else can we learn from the history of poor relief in England? As stated in the introduction, largely due to pressure from Malthusians, a New Poor Law was enacted in 1834, with the intention of substantially lowering the drain on the public purse, in particular by ending the practice of outdoor relief, and forcing paupers into the workhouses. Brundage (1998) describes how the effect was less than desired, however, and that outdoor relief continued, leading to renewed calls in the 1860s for more restrictions. In 1868 the Charity Organization Society was formed working together with the Poor Law Board and using case work (tests of character and tests of destitution) to identify the undeserving who should be sent to the workhouse. In the end, however, the campaign to end outdoor relief failed for several reasons: first, it proved difficult to handle the effects of the trade cycle and mass unemployment; second, there was the rise of democratization and collectivism in politics; third, there was an increasing professionalization of both poor relief and charity; and fourth, the public did not always agree with the suggestions of the economists. In fact, Brundage (1998) argues that both expenditures on poor relief and charity increased throughout the nineteenth century, which gives the lie to those who idealize the nineteenth century as a time when voluntarism flourished while government took a back seat.

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Appendix

A Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
1787					
pcRelief	38	0.25	0.10	0.10	0.50
pcCharity	38	0.03	0.02	0.01	0.07
wage	38	6.81	0.98	5.04	9.04
enclosure	38	0.03	0.04	0.00	0.17
population (in thousands)	38	186	141	17	815
1815					
pcRelief	38	0.64	0.27	0.26	1.67
pcCharity	38	0.06	0.05	0.00	0.25
wage	38	8.17	1.21	6.03	10.65
enclosure	38	0.04	0.04	0.00	0.16
population (in thousands)	38	218	185	16	986
LondonDistance	38	176	109	34	434
HistMigrShare	38	1.01	0.74	0.06	3.44
MigrShare1851	38	0.75	0.65	0.04	2.87
agr. quality	38	0.17	0.16	0.00	0.74
grain suitability	38	0.11	0.12	0.00	0.40
wheat suitability	38	0.11	0.12	0.00	0.40
coast access	38	0.53	0.51	0.00	1.00
rivershare	38	0.12	0.03	0.04	0.18
share_coal	38	0.06	0.10	0.00	0.34
ln(area)	38	1.04	0.61	-0.93	2.75

Table A.1: Summary statistics

B Correlation matrices

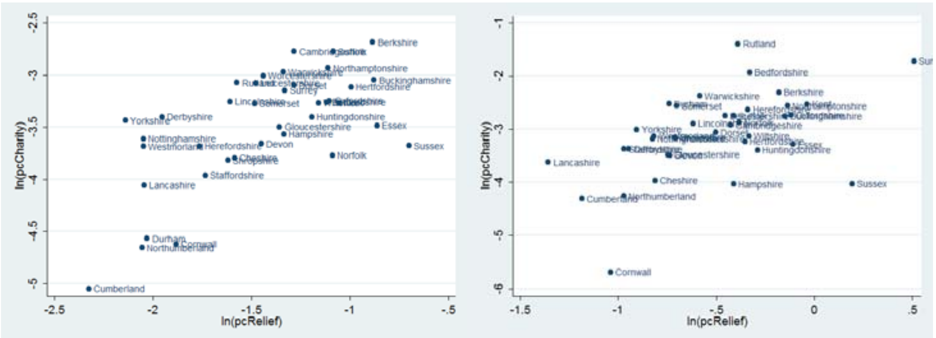
	1787					1815				
	pcRelief	pcCharity	population	wage	enclosure	pcRelief	pcCharity	population	wage	enclosure
pcRelief	1					1				
pcCharity	0.55	1				0.46	1			
population	-0.23	-0.18	1			-0.32	-0.27	1		
wage	0.48	0.27	-0.01	1		0.06	-0.05	0.30	1	
enclosure	0.07	0.33	-0.19	0.02	1	0.09	0.08	-0.26	-0.07	1
agr. quality	0.26	0.34	-0.11	0.07	0.08	0.11	0.03	-0.09	-0.14	0.52
grain suitability	0.40	0.46	-0.19	0.19	-0.05	0.18	0.05	-0.21	-0.27	0.11
wheat suitability	0.38	0.43	-0.17	0.21	-0.09	0.17	0.05	-0.19	-0.27	0.06
coast access	-0.17	-0.52	0.43	-0.20	-0.51	-0.24	-0.39	0.44	0.07	-0.43
rivershare	-0.28	-0.27	0.10	-0.10	-0.22	-0.21	-0.27	0.08	-0.06	-0.16
share_coal	-0.62	-0.49	0.26	-0.28	0.00	-0.53	-0.23	0.34	0.26	-0.18
ln(area)	-0.19	-0.34	0.75	-0.09	-0.27	-0.26	-0.57	0.72	0.21	-0.23
LondonDistance	-0.82	-0.70	0.21	-0.57	-0.20	-0.73	-0.38	0.28	0.24	-0.24
HistMigrShare	0.37	0.04	0.55	0.40	-0.30	0.45	0.00	0.44	0.14	-0.36
MigrShare1851	0.54	0.17	0.39	0.54	-0.35	0.49	0.02	0.28	0.03	-0.29

Table B.1: Correlation matrix by period

	agr. quality	grain suitability	wheat suitability	coast access	rivershare	share_coal	ln(area)	LondonDistance	HistMigrShare	MigrShare1851
agr. quality	1									
grain suitability	0.38	1								
wheat suitability	0.36	0.99	1							
coast access	-0.08	-0.16	-0.13	1						
rivershare	-0.12	0.12	0.13	0.08	1					
share_coal	-0.30	-0.31	-0.31	0.10	0.21	1				
ln(area)	-0.09	-0.18	-0.14	0.66	0.23	0.21	1			
LondonDistance	-0.38	-0.47	-0.45	0.41	0.38	0.54	0.38	1		
HistMigrShare	0.03	0.11	0.13	0.30	-0.03	-0.18	0.46	-0.34	1	
MigrShare1851	0.08	0.22	0.24	0.32	-0.06	-0.34	0.38	-0.45	0.90	1

Table B.2: Correlation matrix for time-invariant variables

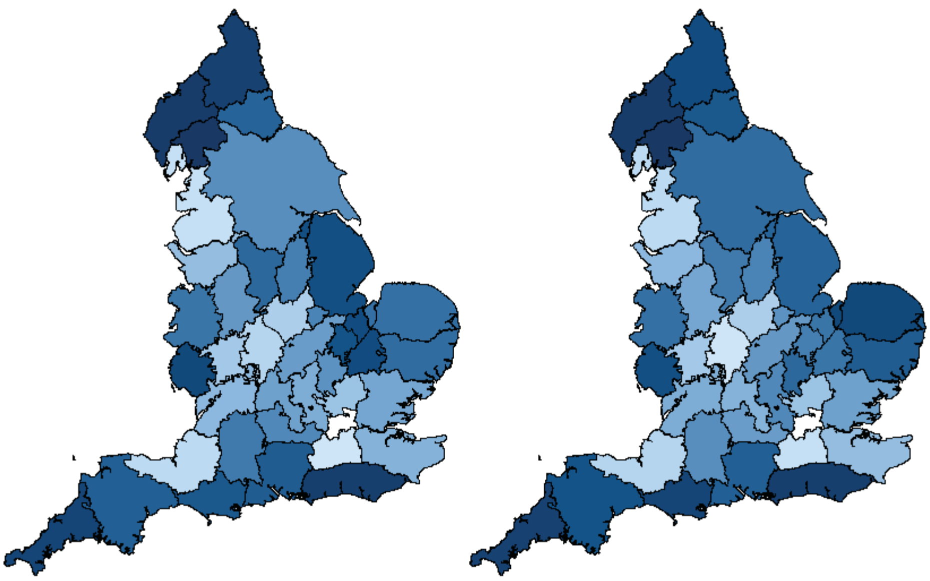
C Scatter plots



(a) 1787 (b) 1815

Figure C.1: Scatter plots of per capita poor relief and per capita charitable income

D Maps of wealth ranking



(a) 1785 (b) 1815

Maps of the wealth ranking in Buckatzsch (1950). Darker shading indicates a lower ranking.

E Robustness checks for OLS estimations

Table E.1: Pooled OLS regressions - Robustness checks

	(1) ln(pcCharity) excl. small counties	(2) ln(pcCharity) excl. London border counties
ln(pcRelief)	1.470***	1.309**
	(0.414)	(0.484)
agr. quality	0.985**	0.269
	(0.455)	(0.524)
wheat suitability	1.821	2.103**
	(1.163)	(0.960)
coast access	-0.444**	-0.313*
	(0.213)	(0.180)
rivershare	1.747	-0.201
	(2.497)	(2.520)
share_coal	1.451	0.315
	(1.165)	(1.170)
ln(area)	0.310	-0.0379
	(0.212)	(0.190)
Constant	-2.459***	-2.350***
	(0.501)	(0.593)
Observations	66	64
R^2	0.619	0.588

Robust standard errors in parentheses, clustered at the county level
All regressions include time and regional fixed effects
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Five smallest counties (by population in 1811): Rutland, Huntingdonshire, Westmorland, Bedfordshire, and Herefordshire.
Counties bordering London: Essex, Hertfordshire, Buckinghamshire, Berkshire, Surrey, and Kent.

F Robustness checks for IV estimations

Table F.1: Robustness checks - 2SLS estimates

	(1) 1st stage: excl. small counties	(2) 2nd stage: excl. small counties	(3) 1st stage: excl. London border counties	(4) 2nd stage: excl. London border counties
ln(LondonDistance)	-0.366***		-0.625***	
	(0.121)		(0.123)	
ln(pcRelief)		2.064***		2.154***
		(0.634)		(0.640)
agr. quality	-0.0333	1.066**	-0.314*	0.436
	(0.229)	(0.428)	(0.159)	(0.517)
wheat suitability	-0.391	2.146**	-0.131	2.215**
	(0.363)	(0.949)	(0.252)	(0.866)
coast access	0.120	-0.457**	0.110*	-0.292
	(0.0833)	(0.217)	(0.0623)	(0.198)
rivershare	0.313	2.023	1.291	0.294
	(1.064)	(2.525)	(0.984)	(2.641)
share_coal	-1.332***	2.479**	-1.095***	1.491
	(0.315)	(1.159)	(0.242)	(1.057)
ln(area)	-0.131	0.415**	-0.0287	-0.00506
	(0.0916)	(0.195)	(0.0594)	(0.202)
Constant	0.647	-2.058***	1.571***	-1.599**
	(0.466)	(0.645)	(0.492)	(0.705)
Observations	66	66	64	64
Kleibergen-Paap		9.171		25.94
Anderson-Rubin (p-value)		0.0280		0.000420
Hansen J (p-value)				

Robust standard errors in parentheses, clustered at the county level

All regressions include time and regional fixed effects

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$