Pro-capitalist Culture and Long-Term Development*

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Abstract

In a life-cycle economy, generationally-linked households differ in wealth, labor productivity and aspirations. Aspirations is pro-capitalist because it incentivizes wealth accumulation. People choose whether or not to be aspirational by trading off the benefit of higher wealth against the psychic cost of falling short. A disproportionate share of wealthier households aspire, and because of their higher fertility during a pre-industrial phase, spur wealth accumulation that eventually tips the economy towards modern growth. With time, the wealthy start lowering fertility, the poor become increasingly numerous and aspirational as their aspirations level comes within their reach. A quantitative exercise shows how this process of cultural change based on economic advantage can account for two centuries of demographic and economic changes in England and the secular decline in the real interest rate.

JEL Codes: D31, J13, N14, O11
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> The poor man's son...when he begins to look around him, admires the condition of the rich...(and) devotes himself for ever to the pursuit of wealth and greatness ... (In) the last dregs of life...he begins at last to find that wealth and greatness are mere trinkets of frivolous utility ...It is this deception which rouses and keeps in continual motion the industry of mankind. It is this which first prompted them to cultivate the ground, to build houses, to found cities and commonwealths, and to invent and improve all the sciences and arts, which ennoble and embellish human life.
>
> Adam Smith, *Theory of Moral Sentiments* (1759)

1 Introduction

Can the spread of pro-capitalist culture spark long term development? This paper is an attempt to answer this question using, as proof of concept, England's remarkable economic and demographic transformations from the late eighteenth to early twentieth centuries.

The cultural value at the center of our story is aspirations, the urge to better oneself, much as conceptualized by Adam Smith in the quote above. By comparing themselves to an aspirational wealth level, households decide whether or not it is worthwhile to "try harder". The choice depends on a tradeoff. Aspiration makes people future-oriented and motivates wealth accumulation. But it comes at a cost, disappointment – utility loss – from falling short. As a result, only people born into wealth or with high labor productivity choose to aspire.

This preference-formation story is embedded into an endogenous growth model with altruistic households and structural change. Production occurs via labor-intensive "Malthusian", or capital-intensive "modern" technologies. Productivity of the latter is initially too low for it to be profitable. Malthusian production, over time, generates knowledge spillovers that latently improve the productivity of the modern technology, eventually tipping the economy towards it. This process of structural change unleashes a fertility transition. The rich who have more children during the Malthusian era are the first to lower fertility as economic growth picks up, reversing their fertility advantage over the poor.

Economic and demographic changes, in turn, alter the population's appetite for aspirations. During the Malthusian phase, the higher fertility and wealth of the rich make it possible for their offspring to be wealthier and aspirational (on average): aspirational behavior spreads through the population and, via wealth accumulation, accelerates economic progress. With the rich starting to restrict fertility, initially this cultural transmission stalls. But soon, the rising fertility gap between the poor and the rich, through its effect on average wealth, brings aspirations within the reach of the poor. And, in this sense, the spread of pro-capitalist aspirations over time therefore owes as much to the "survival of the poor" as it does to the "survival of the rich".

We calibrate the model to key historical facts of the English economy and ask to what extent (unobserved) cultural change in the form of aspirational behavior is consistent with (observed) demographic and economic changes. The model can explain much of the historical fertility gap and timing of the demographic and economic transitions. As by-product, it also explains the "interest rate puzzle", the observed decline of real interest rates from pre-transition high of about 3% to post-transition low of 1.5-2% (Clark, 2007).

In intergenerational models, the long-run interest rate depends on both preference and technology parameters. When preferences are stationary, models of long-run development where production shifts towards more capital-intensive technologies predict a secular *increase* in the real interest rate as in Hansen and Prescott (2002) for example.[1] In our model, besides this channel, preference change makes the population behave more patiently. This happens first due to the increase in the aspirational share of the population. A second source is the secular rise in longevity observed during this period and included in the model to more accurately capture interest rate movements. While both aspirations and longevity are instrumental in lowering the interest rate, the former is quantitatively more significant in capturing the timing and relative magnitude of the decline.

Using counterfactuals, we then show that in the absence of aspirations, both economic and fertility transitions are significantly slower, and the fertility gap between rich and poor households higher. We take these results to illustrate the potential for cultural change to drive economic change. Filtered through the model's mechanisms, that power stems in large measure from proximate economic forces working through cultural change. The residual can be attributed to non-modeled intra-family transmission of human capital, specialization, occupational choice (possibly even genetic traits) that contribute to the intergenerational persistence of labor productivity.

A robust tradition in the social sciences dating back to Max Weber's work (1930) on the Protestant Reformation places cultural change at the heart of economic development. Subsequent variations on this theme include Hagen's (1962) thesis that the genesis of growth lies in transforming societies bound by traditional and authoritative family structures into those that emphasize personal initiative and autonomy, as well as Landes' (1998) attribution of England's economic success to an appropriate set of cultural traits including empiricism, competitiveness and national cohesion.

Several recent works have revived this tradition in the macro-development literature. The key

[1] In the two-period overlapping generations model, because wealth is (primarily) accumulated out of labor earnings, a higher capital intensity of production implies a smaller share of output for labor and, all else equal, relative scarcity of capital.

mechanism identified, starting with Galor and Moav (2002), is intergenerational link. For example, in Galor and Moav, the higher reproductive success of wealthier households in the Malthusian era genetically transmits desirable, pro-capitalist, traits and values that spur wealth and human capital accumulation. In Doepke and Zilibotti (2008), intergenerationally transmitted work ethic and human capital explain the fall of the aristocracy during industrialization, while risk-taking in Galor and Michalapoulos (2012) and patience formation in Galor and Özak (2016) account for the divergent fortunes of nations. Perhaps the most provocative contribution has been Clark (2007) who argues that England's medieval and early-modern populations transmitted to each successive generation – genetically – behavioral patterns such as thrift, patience and aspirations that were the source of its subsequent technological and organizational innovations.[2] Similar to Galor and Moav (2002), Galor and Michalapoulos (2012) and Clark (2007), differential fertility is essential to the spread of pro-capitalist values in our model. Differently, and similar to Doepke and Zilibotti (2008) and Galor and Özak (2018), these values are the outcomes of rational choice and comparative advantage rather than genetic transmission.

In focusing on aspirations, we build on a rich literature that primarily studies the outcomes of exogenous aspirational (status-seeking) preferences. Most closely related to our work are papers that take a choice-theoretic approach to understanding why and how people become aspirational such as Barnett *et al.* (2010), Dalton *et al.* (2016) and Genicot and Ray (2010).[3] That the behavior of aspirational households is pro-capitalist is similar to Strulik (2013) where the faster pace of wealth accumulation in status-conscious households adds to economic growth which, in turn, improves the welfare of non-status-conscious households. Fertility change and endogenous aspirations add interesting non-monotonic dynamics to this secular change. Implications of the preference externality for inequality, in particular its ability to drive polarization in wealth and lifetime welfare, are studied in our companion paper, Allen and Chakraborty (2021).

Section 2 below presents the household's decision problem and shows how aspirations determines wealth and fertility behavior and depends on household characteristics. Section 3 constructs the dynamic general equilibrium. Baseline quantitative results for the English economy and exten-

[2] A central premise of Clark's story is the uniquely higher fertility of the English rich – "survival of the richest" – led to the spread of values that made them rich in the first place. How did those values spread? Clark writes: "we may speculate that England's advantage lay in the rapid cultural, and potentially also genetic, diffusion of the values of the economically successful throughout society in the years 1200-1800" (p 271). Many commentators, in emphasizing the genetics interpretation, point out two problems besides the unsavory suggestion of social Darwinism (Solow, 2007): genetics-based transmission requires the transmission rate to be hundred per cent, and empirically, it is hard to identify a cohesive set of pro-capitalist genetic attributes. See Allen (2008) and the special issue of the *European Review of Economic History*, 12(2), 2008.

[3] There is, of course, a deeper body of work on exogenous aspirations or status-seeking. Some recent contributions on the macro side of that literature related to our paper are Alonso-Carrera *et al.* (2007), Tournemaine (2008), Kawamoto (2009), Moav and Neeman (2010, 2012), and Alvarez-Cuadrado and Long (2012).

sions are discussed in Section 4. Section 5 concludes.

2 Households

2.1 Preferences

The economy is populated by a continuum of agents (interchangeably referred to as households) who live for three periods: dormant childhood, active youth and retired old age. Economically active young agents start their working lives with inherited wealth and exogenous labor productivity. They choose how many children to have in their youth and how much to bequeath to each of them.

People are born with identical meta preferences and rationally choose whether or not to become aspirational. Aspirational households are extrinsically motivated by a benchmark that depends on economy-wide aggregates. Specifically, suppose that aspirational utility depends on $\alpha = \kappa\bar{z}/z$, where z is the household's savings, $\bar{z}$ the economy-wide average savings and $\kappa > 0$ a scaling constant. Households obtain ego-rent when they fare better than the benchmark $\kappa\bar{z}$, disutility when worse.[4] Households become aspirational if they expect to be better off from it, similar to Barnett *et al.*'s (2010) model of status-seeking in consumption.

In any period-t, given initial wealth a_t^i and labor productivity ε_t^i, household i chooses the vector $\left(c_{1t}^i, c_{2t+1}^i, z_t^i, n_t^i, b_{t+1}^i, \mathcal{I}_t\right)$ to maximize expected lifetime utility:

$$U_{it} = \ln(c_{1t}^i) + \beta p \ln(c_{2t+1}^i) + \gamma\left[\theta\ln(n_t^i) + (1-\theta)\ln\left(\max\left\{b_{t+1}^i, b_0\right\}\right)\right] - \mathcal{I}_t^i\lambda\ln\alpha_t^i \tag{1}$$

subject to the budget constraints

$$c_{1t}^i + z_t^i + \delta n_t^i = (1-\tau n_t^i)\varepsilon_t^i w_t + a_t^i, \tag{2}$$

$$p c_{2t+1}^i = R_{t+1} z_t^i - n_t^i b_{t+1}^i. \tag{3}$$

Here $n_t \in [0, 1/\tau]$ denotes net fertility, and each surviving child requires δ units of the consumption good and $\tau \in (0,1)$ units of parental time. Labor earns the competitive efficiency wage w_t and capital the interest factor $R_t \equiv 1 + r_t$. Agents take as given the factor prices $\{w_t, R_t\}$. Since bequests are made out of accumulated wealth, inheritance $a_t^i \geq 0$ includes interest income.

If the household chooses to be aspirational, the indicator function $\mathcal{I}_t$ takes the value 1; it is zero

[4] By assumption the aspirational good, wealth, has economic value to both agents and society. This presumes institutional preconditions that ensure aspirations can be channeled into (mainly) productive use instead of theft, corruption, rent-seeking and conflict.

otherwise. The parameter $\lambda > 0$ measures responsiveness to the aspirations gap α.[5] Adult survival, $p \in [0, 1]$, denotes the fraction of late life that the household is alive for. The second period budget constraint embodies two assumptions. First, bequests are earmarked in advance. Secondly, old-age consumption is funded out of annuitized returns on remaining wealth (Barro and Friedman, 1977). The perfect annuities assumption is a simple way to account for the effect of mortality on wealth accumulation: individuals expecting to live longer have a greater need to support consumption when retired.[6] Observe also that the utility function (1) treats bequest as a luxury good and the household can choose not to leave any (Moav, 2002). While this assumption is not essential for the qualitative properties of the model, it helps to match fertility gaps between the rich and poor. A similar assumption is often made in household fertility models where child quality takes the form of human capital, as in Becker *et al.* (1990) for example.[7]

Each household is endowed with one unit of labor time in youth and receives the labor productivity draw ε_t that follows the AR(1) process

$$\ln \varepsilon_t = \rho \ln \varepsilon_{t-1} + \tilde{u}_t. \tag{4}$$

In particular, productivity depends on parental productivity ε_{t-1} and an *iid* white noise term $\tilde{u} \sim N(0, \sigma_u^2)$. The parameter $\rho \in (0, 1)$ represents (unmodeled) parental influence on labor productivity via human capital, culture and occupational choice, as well as the genetic transmission of complementary labor market abilities.

Let the cumulative distribution of inherited wealth in generation t be given by $G_t(a)$, the proportion of agents with assets below some a. The economy starts at $t = 0$ from an initial distribution $G_0(a)$.

2.2 Decisions

We analyze household behavior in two stages. First, contingent on aspirations type, we solve for a household's consumption smoothing and fertility decisions. Then we let the household choose its aspirational behavior based on the indirect utilities from those decisions.

[5] An alternative, less tractable, specification is to allow households to choose λ itself on some interval $[0, \bar{\lambda}]$.

[6] Specifically we are assuming that the unconsumed wealth of the deceased is distributed equally among the survivors through the annuity provider.

[7] Human capital transmission is not explicitly modeled in the interest of parsimony. It is absorbed in the persistence parameter ρ in equation (4) below.

Economic and Fertility Decisions

Given $\mathcal{I}_t$, consider decisions on the number of children, savings, and bequests. The household faces two possible corner solutions for bequests and fertility which lead to four possible sets of solutions as specified in Table 1, with the corresponding "propensities" or proportionality constants listed in Table 2. Positive bequest requires the assumption $\theta > 1/2$ under which the second order conditions are satisfied.

	Household Choices			
	Interior n Interior b	Interior n Corner b	Corner n Interior b	Corner n Corner b
z	$\sigma_z(\mathcal{I}_t^i\lambda)(\varepsilon_t^i w_t + a_t^i)$	$\mu_z(\mathcal{I}_t^i\lambda)(\varepsilon_t^i w_t + a_t^i)$	$\xi_z(\mathcal{I}_t^i\lambda)(\tau a_t^i - \delta)$	$\chi_z(\mathcal{I}_t^i\lambda)(\tau a_t^i - \delta)$
n	$\sigma_n(\mathcal{I}_t^i\lambda)\left(\frac{\varepsilon_t^i w_t + a_t^i}{\tau\varepsilon_t^i w_t + \delta}\right)$	$\mu_n(\mathcal{I}_t^i\lambda)\left(\frac{\varepsilon_t^i w_t + a_t^i}{\tau\varepsilon_t^i w_t + \delta}\right)$	$1/\tau$	$1/\tau$
b	$\sigma_b(\mathcal{I}_t^i\lambda)R_{t+1}(\tau\varepsilon_t^i w_t + \delta)$	0	$\xi_b(\mathcal{I}_t^i\lambda)R_{t+1}(\tau a_t^i - \delta)$	0

Table 1: Household decisions

	Propensities			
	$\sigma_x(\mathcal{I}_t^i\lambda)$	$\mu_x(\mathcal{I}_t^i\lambda)$	$\xi_x(\mathcal{I}_t^i\lambda)$	$\chi_x(\mathcal{I}_t^i\lambda)$
z	$\frac{p\beta+\gamma(1-\theta)+\mathcal{I}_t^i\lambda}{1+p\beta+\gamma\theta+\mathcal{I}_t^i\lambda}$	$\frac{p\beta+\mathcal{I}_t^i\lambda}{1+p\beta+\gamma\theta+\mathcal{I}_t^i\lambda}$	$\frac{p\beta+\gamma(1-\theta)+\mathcal{I}_t^i\lambda}{\tau(1+p\beta+\gamma(1-\theta)+\mathcal{I}_t^i\lambda)}$	$\frac{p\beta+\mathcal{I}_t^i\lambda}{\tau(1+p\beta+\mathcal{I}_t^i\lambda)}$
n	$\frac{\gamma(2\theta-1)}{1+p\beta+\gamma\theta+\mathcal{I}_t^i\lambda}$	$\frac{\gamma\theta}{1+p\beta+\gamma\theta+\mathcal{I}_t^i\lambda}$	—	—
b	$\frac{1-\theta}{2\theta-1}\left(1+\frac{\mathcal{I}_t^i\lambda}{p\beta+\gamma(1-\theta)}\right)$	—	$\frac{\gamma(1-\theta)(p\beta+\gamma(1-\theta)+\mathcal{I}_t^i\lambda)}{(p\beta+\gamma(1-\theta))(1+p\beta+\gamma(1-\theta)+\mathcal{I}_t^i\lambda)}$	—

Table 2: Propensities as functions of aspirations

How does the behavior of aspirational households differ from non-aspirational ones? For $x \in \{\sigma, \mu, \xi, \chi\}$, we have

$$x_n(\lambda) < x_n(0), \; x_z(\lambda) > x_z(0), \; x_b(\lambda) > x_b(0). \tag{5}$$

Observe how aspirations is pro-capitalist and how the parameter λ works similar to the subjective discount rate $p\beta$. From Table 2, the effective propensity to accumulate wealth depends positively on $p\beta + \lambda\mathcal{I}_i \in \{p\beta, p\beta + \lambda\}$. Aspirational households are, therefore, more future-oriented in a similar way as patient households in Galor and Özak (2016).

Secondly, for a wealth-productivity pair $\left(a_t^i, \varepsilon_t^i\right)$, (5) tells us that aspirational households have fewer children. They substitute away from child quantity towards child quality and their own future consumption. However, since aspirational households are expected to have higher $\{a_t, \varepsilon_t\}$ as discussed below, it is *ex ante* unclear whether they have more or fewer children than non-aspirational households.

Third, how fertility responds to labor earnings depends on household wealth. From Table 1, as long as $a_t^i < \delta/\tau$, fertility increases with labor income regardless of whether or not the household is aspirational. An increase in the wage rate discourages fertility through the familiar opportunity cost (substitution) effect and (pure) real income effect but discourages fertility through the wealth effect. For wealthier households, the wealth effect is relatively smaller as more of their overall wealth $\varepsilon w + a$ comes from a. For $a > \delta/\tau$, the combined substitution and pure income effects dominate the wealth effect. As the wage rate grows over time, this dependence of fertility on household wealth will produce a fertility transition where household fertility switches from responding positively to wage growth, to responding negatively.

Finally, aspirational households have a higher bequest propensity (with respect to cost per child, not household income) as seen from (5) since bequests are made out of accumulated wealth. That bequest per child is increasing in the marginal cost $\tau\epsilon w_t + \delta$, is simply the quantity-quality tradeoff at work.[8]

Aspirations Decision

The decision to be aspirational is based on the indirect utilities from aspirational versus non-aspirational choices based on Table 1:

$$\max_{x \in \{\sigma, \mu, \xi, \chi\}, \mathcal{I}_t^i \in \{0,1\}} V_x(a, \varepsilon, \mathcal{I}_t^i) \tag{6}$$

[8] While bequest per child does not depend on household income, total bequest does. For example, for aspirational households with interior solutions for fertility and bequest per child, the household's total bequest allocation $n_t b_{t+1} = \frac{\gamma(1-\theta)}{1+p\beta+\lambda+\gamma\theta}\left[1 + \frac{\lambda}{p\beta+\gamma(1-\theta)}\right] R_{t+1}(\varepsilon_t^i w_t + a_t^i)$ is increasing in its potential income.

where we have

$$\begin{aligned} V_\sigma(a,\varepsilon,\lambda) &= \ln[\sigma_{c1}(\lambda)(\varepsilon_{it}w_t + a_t)] + p\beta\ln[\sigma_{c2}(\lambda)R_{t+1}(\varepsilon_{it}w_t + a_t)] \\ &\quad + \gamma\left[\theta\ln\left[\sigma_n(\lambda)\frac{\varepsilon_{it}w_t + a_t}{\tau\varepsilon_{it}w_t + \delta}\right] + (1-\theta)\ln[\sigma_b(\lambda)R_{t+1}(\tau\varepsilon_{it}w_t + \delta)]\right] \\ &\quad - \lambda\ln\left[\frac{\bar{z}_t}{\sigma_z(\lambda)(\varepsilon_{it}w_t + a_t)}\right] \end{aligned} \tag{7a}$$

$$\begin{aligned} V_\mu(a,\varepsilon,\lambda) &= \ln[\mu_{c1}(\lambda)(\varepsilon_{it}w_t + a_t)] + p\beta\ln[\mu_{c2}(\lambda)R_{t+1}(\varepsilon_{it}w_t + a_t)] \\ &\quad + \gamma\left[\theta\ln\left[\mu_n(\lambda)\frac{\varepsilon_{it}w_t + a_t}{\tau\varepsilon_{it}w_t + \delta}\right] + (1-\theta)\ln[b_0]\right] \\ &\quad - \lambda\ln\left[\frac{\bar{z}_t}{\mu_z(\lambda)(\varepsilon_{it}w_t + a_t - \bar{c})}\right] \end{aligned} \tag{7b}$$

$$\begin{aligned} V_\xi(a,\varepsilon,\lambda) &= \ln[\xi_{c1}(\lambda)(\tau a_t^i - \delta)] + p\beta\ln[\xi_{c2}(\lambda)R_{t+1}(\tau a_t^i - \delta)] \\ &\quad + \gamma\left[\theta\ln\left[\frac{1}{\tau}\right] + (1-\theta)\ln[\xi_b(\lambda)R_{t+1}(\tau a_t^i - \delta)]\right] \\ &\quad - \lambda\ln\left[\frac{\bar{z}_t}{\xi_z(\lambda)(\tau a_t^i - \delta)}\right] \end{aligned} \tag{7c}$$

$$\begin{aligned} V_\chi(a,\varepsilon,\lambda) &= \ln[\chi_{c1}(\lambda)(\tau a_t^i - \delta)] + p\beta\ln[\chi_{c2}(\lambda)R_{t+1}(\tau a_t^i - \delta)] \\ &\quad + \gamma\left[\theta\ln\left[\frac{1}{\tau}\right] + (1-\theta)\ln[b_0]\right] \\ &\quad - \lambda\ln\left[\frac{\bar{z}_t}{\chi_z(\lambda)(\tau a_t^i - \delta)}\right] \end{aligned} \tag{7d}$$

corresponding to the four types of aspirations-contingent household equilibria.

We omit algebraic details of the choice in the interest of brevity; the interested reader is referred to Allen and Chakraborty (2021) for a simpler version of this set-up. The basic, intuitively plausible, result here is that more affluent households will choose to be aspirational. This is readily seen from Figure 1 that is based on the parameter values in (Table 3), used later for the numerical simulations. Affluence in the model comes from either high inheritance or high labor productivity. Therefore, asset-poor households need a high labor draw to justify becoming aspirational, while less productive households are able to become aspirational as long as they are born into wealth. Among households that receive an inheritance, the ability to aspire is yet another margin through which their economic advantage is intergenerationally transmitted.

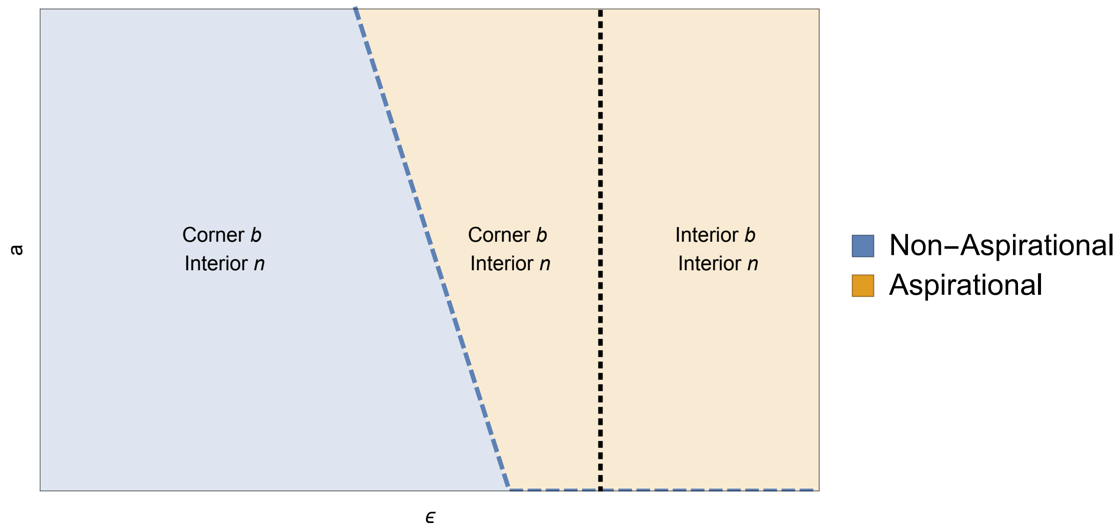


Figure 1: Aspirations Decision

3 Production and General Equilibrium

The aggregate labor force or number of workers (N_t), savings (Z_t) and effective labor supply (L_t) are given by

$$N_t = \sum_{j=1}^{L_{t-1}} \omega_{t-1}^j n_{t-1}^j \tag{8}$$

$$Z_t = \sum_{j=1}^{L_t} \omega_{t-1}^j z_t^j \tag{9}$$

$$L_t = \sum_{j=1}^{L_t} (1 - \tau n_t^j) \omega_{t-1}^j \epsilon_t^j \tag{10}$$

and $\bar{z}_t = Z_t/N_t$. Since fertility need not take integer values, we weigh individual households by their population weights ω when aggregating. The last equation adjusts each young household's labor endowment by time allocated towards market work. Let $k_t \equiv K_t/N_t$ denote the capital per worker and the depreciation rate of capital be hundred percent.

3.1 Technologies

The unique final good is produced using one of two technologies that are distinguished by their capital intensity and productivity growth. The Malthusian technology combines the outputs of labor-dependent home and agricultural production with labor- and capital-dependent cottage industry production. Labor is either engaged in the former (ℓ_t^M) or the latter (L_t^M) with output determined by

$$Y_t^M = B_0 \ell_t^M + B_1 \left(K_t^M\right)^{\phi} \left(L_t^M\right)^{1-\phi}, \quad \phi \in (0,1) \tag{11}$$

and $L_t^M = L_t - \ell_t^M$. The Malthusian technology does not enjoy productivity growth, any increase in output per worker occurs from capital deepening.

The modern technology combines the complementary inputs, physical capital and labor,

$$Y_t^S = \left(K_t^S\right)^{\phi} \left(A_t L_t^S\right)^{1-\phi}, \tag{12}$$

with labor-augmenting productivity A_t growing over time. To understand how aspirations can facilitate the transition to modern economic growth, we introduce a simple endogenous growth mechanism that connects wealth accumulation to productivity growth. Specifically, the growth rate of A depends on lagged capital per worker according to

$$A_t = A_{t-1}\left[1 + \zeta(k_{t-1})\right] \tag{13}$$

where the externality is subject to threshold effect as in Azariadis and Stachurski (2005):

$$\zeta(k) = \frac{\nu}{1 + \left(k/\bar{k}\right)^{-1/\chi}}. \tag{14}$$

The parameter ν pins down the long-run growth rate of technology, χ determines the speed of the transition, and $\bar{k}$ is threshold level of capital per worker required to generate productivity growth.[9] Observe that the spillover effect can arise not only from modern production, but also from Malthusian production. For example, working with traditional manufacturing can generate knowledge gains about how to mechanize certain tasks or organize operations in a factory that become relevant only when the modern production is (later) used. Observe too that the productivity growth rate can be time-varying; it is only after the economy switches over to modern production that it converges to a constant value and capital per effective worker (k/A) to its steady state.

[9] A suitable choice of $\bar{k}$ ensures that the economy stays in the Malthusian era long enough for the model to settle down from the initial conditions.

3.2 General Equilibrium

Under perfectly competitive markets, the real wage rate per efficiency unit of labor and rental rate on capital are given by the corresponding marginal products

$$
\begin{aligned}
w_t &= \partial Y_t / \partial L_t, && (15)\\
q_t &= \partial Y_t / \partial K_t && (16)
\end{aligned}
$$

where $Y_t \in \{Y_t^M, Y_t^S\}$ depending on the technological regime. The real interest rate is then $r_t = q_t - 1$ as the depreciation rate of physical capital is unity.

As in the standard OLG model, given an initial stock of capital K_0 owned by the initial old generation and initial productivity A_0, the asset market clearing condition

$$K_t = Z_{t-1} \tag{17}$$

under general equilibrium prices (15) and (16) describes the dynamic equilibrium path of this economy. In this equilibrium, the allocation of capital and labor across the two technologies is determined by the following problem (Hansen and Prescott, 2002):

$$
\begin{aligned}
\max_{K_t^M, L_t^M, K_t^S, L_t^S} \; & Y_t^M + Y_t^S \\
\text{s.t. } K_t &= K_t^M + K_t^S \\
L_t &= L_t^M + L_t^S
\end{aligned}
\tag{18}
$$

The allocation may have resources devoted entirely to the Malthusian technology, or to the modern technology or, in the transition phase, to both. Since labor productivity in the modern technology grows incrementally, when A_0 is small enough, the economy starts out fully specializing in Malthusian production. The time-period during which the Malthusian technology is solely used will be called the "Malthusian regime"; similarly "modern regime" for the modern technology.

Labor usage in both types of Malthusian production implies

$$L_t^M = \left[\frac{(1-\phi)B_1}{B_0}\right]^{1/\phi} K_t^M \equiv bK_t^M.$$

as long as $\ell_t^M \geq 0$, that is, $K_t^M \leq L_t/b$. As capital accumulates in the Malthusian regime, the marginal product of labor in cottage production rises, drawing labor from home and agricultural production. Though the competitive equilibrium rental rate, $q_t = \partial Y_t^M / \partial K_t^M = \phi b^{1-\phi} B_1$, itself does not change, the effective share of capital in output

$$\frac{q_t K_t^M}{Y_t^M} = \frac{\phi b^{1-\phi} B_1 K_t^M}{B_0(1 - bK_t^M) + b^{1-\phi} B_1 K_t^M} \tag{19}$$

does and steadily rises towards ϕ. For $K_t^M > L_t/b$, this share is exactly equal to ϕ: labor is so much more productive in cottage-industry production that home and agricultural production shuts down. In section 4 below, we make use of (19) to reproduce the high interest rate observed in England prior to industrialization.

3.3 Dynamics

Definition 1. *A dynamic general equilibrium of this economy consists of a sequence of aggregate variables* $\{K_t^M, K_t^S, K_t, A_t, N_t, L_t\}_{t=0}^{\infty}$, *factor prices* $\{w_t, q_t\}$ *that satisfy the household's decision problem* (1) *and* (11), (12), (15)–(18) *given* $K_0 > 0$ *and* $G_0(a)$.

Before turning to a quantitative exploration of the model, it will be useful to provide a brief outline of the dynamics. This depends on several turning points: the switch to modern technology, the inflection point in labor productivity, the switch from rising fertility to falling fertility among the rich and a similar switch among the poor.[10] While the theory unambiguously predicts that the poor start regulating fertility after the rich, other aspects such as when the economy switches to modern production, whether or not the fertility-income relationship starts changing before or after that switch depend on model parameters that drive aspirations formation and productivity growth.

Based on the numerical values used in section 4 below, the economy goes through three distinct phases in sequence. First, starting from a pre-industrial base where production relies on the Malthusian technology, the fertility-income relationship is positive for all households. Since $a < \delta/\tau$ during this phase, incremental wage growth from capital accumulation causes fertility to increase. Wealthier or richer households become aspirational on average as illustrated in Figure 1, have more children *and* bequeath more. Consequently pro-capitalist aspirational behavior spreads through the population, and moves the economy closer to a tipping point, $\hat{k}$, where the modern technology becomes more productive.

In the second phase of the transition, for $k > \hat{k}$, wage per efficiency of labor rises for the substitution effect to dominate the total income effect: the aspirational rich now start lowering fertility while the non-aspirational poor continue to increase theirs. The gradual decline in the fertility gap between the rich and the poor causes a temporary slowdown in the spread of aspirational

[10]In what follows, "rich" and "poor" refer to the highest and lowest terciles of the population by inherited wealth.

behavior as well as a cultural catchup. With the increase in $\bar{z}/z$ slowing down, aspirations now become attainable for those born with little wealth but relatively high ε. This renewed impetus to capital accumulation pushes the economy into a third phase: the poor start reducing fertility, and wealth accumulation picks up across all lineages. Asymptotically the economy converges to a balanced growth path with low fertility, slightly higher fertility of the poor relative to the rich, and a stable share of aspirational households in the population.

4 Quantitative Results

4.1 Parameterization

The model is calibrated to the English demographic and economic transitions during late eighteenth to early twentieth centuries. Calibrated parameters are reported in Table 3. The fertility transition and the fertility gap between rich and poor households are both essential to the cultural and economic transitions in the model. Our approach is to pick parameter values to pin down the pre-transition TFR, pre-transition fertility gap between the top and bottom terciles of the population, post-transition TFR at replacement (asymptotically) and the timing of the fertility transition. We then evaluate how much of the subsequent demographic and economic changes are explained by the model.

Household Parameters

Working life starts at age 15 and the length of a generation is 25 years. This implies $\beta = 0.99^{100} = 0.37$ based on conventional estimates of the quarterly discount rate.

As child mortality is not explicitly modeled, n^i represents the number of surviving children in household i, and n the net fertility rate. Historical data on these come from Wrigley and Schofeld (1981) and Office of National Statistics (2011). Historical data on cross-sectional fertility is taken from Clark and Cummins' (2014) study of English fertility across wealth terciles during 1500-1879. Utilizing information from wills, Clark and Cummins find that in the 280 years preceding the start of the industrial revolution the net fertility of the wealthiest tercile of the English population was 1.93 children per adult and of the poorest tercile 1.27 children per adult. We choose λ to target this fertility gap of 0.66 children per adult in the pre-transition phase.

The parameters (γ, θ, τ) jointly determine long-run fertility. The time cost of child rearing τ is calibrated to Haveman and Wolf (1995). The two parameters γ and θ are chosen jointly to ensure long-run fertility is at replacement.[11] The resource cost of raising children, δ, is picked to match

[11] The calibration followed the process of selecting a θ and then changing γ to match the target. Results are

Parameter	Value	Description	Source
β	0.366	Rate of Time Preference	$0.99^{4\times25}$
γ	0.95	Preference Parameter: Utility From Children	Long-run fertility is at replacement
τ	0.15	Time Cost of Children	
δ	0.25	Resource Cost of Children	Clark-Cummins (2014): Match top wealth tercile fertility
θ	0.625	Preference Parameter: Utility From Children	Long-run fertility is at replacement
λ	0.2	Social Status Preference	
κ	1	Social Status	
α	1/3	Capital Share: Modern Tech	
ϕ	1/3	Capital Share: Malthusian Tech	Malthusian interest rate (Clark, 2007)
B_0	7.6	Labor Intensive Production Parameter: Malthusian Tech	
B_1	4.30887	Capital Intensive Production Parameter: Malthusian Tech	Malthusian interest rate (Clark, 2007)
ν	0.64	Technology Externality	Annual Growth Rate 2%
$\bar{k}$	1.5	Technology Externality	
χ	0.25	Technology Externality	
ρ	0.75	Household Productivity Persistence	
b_0	3.0	Bequest Parameter	

Table 3: Parameter Values

fertility of the wealthiest tercile in the Malthusian era (Clark and Cummins, 2014).

This leaves the household parameters (p, b_0, ρ) to calibrate. For the survival probability, unlike in the model where p is constant, we fit the sequence $\{p_t\}$ to historical life expectancy at 25 year intervals as in Table 4 (Wrigley and Schofeld, 1981) The parameter b_0 amplifies differences in fertility, savings, and bequests between rich and poor households induced by aspirational choice. It is chosen to better match the large fertility gap seen in the data. Finally, $\rho = 0.75$ generates intergenerational correlation of wealth (saving) in line with the 0.69 estimate reported by Clark and Cummins' (2014, Table 8) for "rich and prosperous" households in England and higher than the 0.4 for "poor" households.

Technology

For the modern technology, we choose $\phi = 1/3$, the standard value used in the literature. This is the same value used in (11), though as discussed above, capital's effective share of output is lower and time-varying in the Malthusian regime. The labor-intensive production parameter B_0 in (11) pins down the wage rate in the Malthusian era. There are trade-offs in setting this parameter.

qualitatively robust to alternative values of θ.

Year	Life Expectancy at 15	p_t
1550	51.36	0.67
1575	52.50	0.71
1600	51.92	0.48
1625	51.79	0.70
1650	51.24	0.68
1675	51.73	0.71
1700	52.61	0.69
1725	52.41	0.50
1750	53.87	0.55
1775	54.76	0.59
1800	55.15	0.61
1825	55.92	0.64
1850	58.88	0.76
1875	56.77	0.67
1900	58.89	0.76
1925	64.89	1
1950	68.85	1
1975	70.83	1
2000	75.74	1

Table 4: Imputed Late-Life Survival

On the one hand, it has to be high enough for labor-intensive production to be significant. On the other, too high of a value makes it difficult to match the data since it lowers the interest rate and produces a Malthusian wage rate that shrinks the fertility gap between the rich and the poor. The value reported in Table 3 strikes a balance between these tradeoffs.

For the other parameter, B_1, we turn to historical rates of return to capital. High interest rates in pre-industrial England hovered close to 6% around 1500 and fell to 4 – 5% in the decades immediately before the industrial revolution (Clark, 2007, Fig 9.1; see also McCloskey and Nash, 1981). We calibrate B_1 to be consistent with this data during the Malthusian era. This implies, via equation (19), capital's share of about 0.3 prior to takeoff. Figure 2 illustrates the evolution of capital's share of output over time.[12]

[12] At about 0.3 in the pre-transition phase, the implied share of capital in Figure 2 is higher than typically used in the literature. For example, in Hansen and Prescott's (2002) influential quantitative work on long-term development, it is only 0.1. It is important to keep in mind, however, that capital here is not just a factor of production but also the only durable asset in the Malthusian regime. If land were to serve as a second source of wealth, what would be relevant for historical returns to durable assets is the combined income share of land and capital. This combined share in Malthusian production is 0.4 in Hansen and Prescott (2002), same as the share of capital in their Solovian technology. An earlier version of our model did include land as a separate input and source of inheritance, but without labor productivity heterogeneity. In the absence of frictions, for example, restrictions on who can own and farm land, that model produced similar quantitative predictions as the capital-only model.

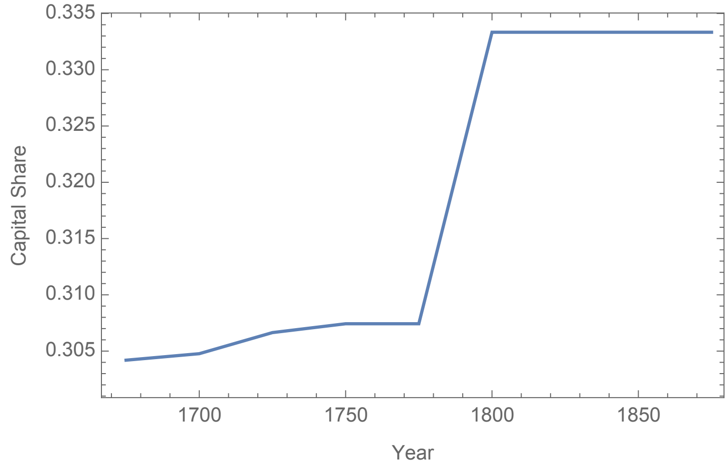


Figure 2: Evolution of Capital's Share of Output

Three other technology parameters, ν, $\bar{k}$ and χ, are calibrated to match the long-run growth rate (ν) and speed and timing of the economic transition. $\bar{k}$ is large enough that the economy settles down from its initial conditions before the transition occurs, χ is then chosen to match the takeoff from the Malthusian to modern era.

4.2 Results

4.2.1 Demographic Change

We begin with the demographic transition. Figure 3 shows the evolution of the cross-sectional (net) fertility rate on the left, and fertility gap between the richest and poorest terciles (right panel) on the right.[13] Fertility of the rich exceeds that of the poor during the Malthusian era by about 0.5, about three-quarters of the actual gap of 0.66 in the Clark and Cummins data. Clark and Cummins (2014) note that differential rates of survival between the top and bottom wealth terciles account for about 10% of the observed fertility gap, which means a little over 7% of the gap remains unexplained by the socio-economic factors identified by our model.[14] Two opposing effects are behind the higher fertility of the rich. First, since wealthier households (as measured by inheritance) on average disproportionately choose to be aspirational and have a lower fertility propensity (σ_n), they tend to have fewer children at a given income level. On the other hand, their higher wealth and income translates into higher demand for children. The bottomline is, in the Malthusian regime, the latter dominates fertility choice.

[13]Results are based on simulating the dynamic model five times using different draws of household productivities. We use "rich" and "wealthy" interchangeably.

[14]Besides the fertility gap, λ also affects capital accumulation: a higher value speeds it up at the cost of narrowing the gap between rich and poor fertility (see Table 1 propensities). This is why predicted fertility gap is less than the actual gap.

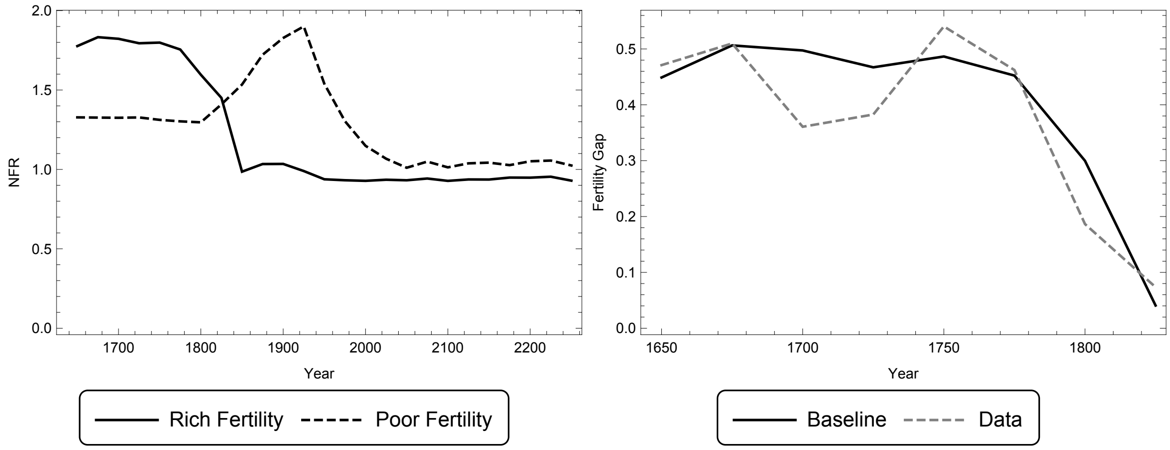


Figure 3: Fertility Transition: Model vs. Data

The subsequent population dynamics is anticipated by the theory. The switch to the modern technology does not occur until 1800. But capital deepening in the last legs of the Malthusian era, during the eighteenth century, raises wages sufficiently to amplify the opportunity cost effect. Wealth levels rise too but not as rapidly; richer households now find it more advantageous to control family size. This starts the fertility transition around 1750, similar to the turning point picked up in Clark and Cummins' (2014) data (Figure 3, right panel).

Within a generation of the onset of full-scale industrialization in 1800 in the model, poorer households start raising their fertility in response to rising wages. This part of the transition is an implication of the model and matches the empirical counterpart remarkably well, as the right panel of Figure 3 shows. Clark and Cummins' data ends in 1800; the model's predictions of the fertility gap after 1800, based on simulation results in the left panel of Figure 3, are shown in Figure 4. By the early 1900s the rich are more-or-less at replacement, while the poor are still raising their fertility which continues until 1950 when they start restricting family size. Asymptotically both fertility rates converge to replacement, though the poor always lag the rich.

Amplifying the effect of rising wages on fertility is the effect of the interest rate working through the bequest motive. Rich households, because they are disproportionately aspirational, save at a higher rate on average than poor households. The falling interest rate means that these households see their future income fall relative to poor households which lowers transfers (bequests) to their offspring. In particular, using the optimal choices from Table 2, for the same productivity draw ε, aspirational households lower their bequests by a greater magnitude than non-aspirational households: $\partial b^2_{t+1}/\partial R_{t+1} > \partial b^1_{t+1}/R_{t+1}$. This then has an effect on fertility behavior of their offspring. Of course aspirational households also have a lower propensity to have children than non-aspirational households, so for their fertility to fall by more because of lower inheri-

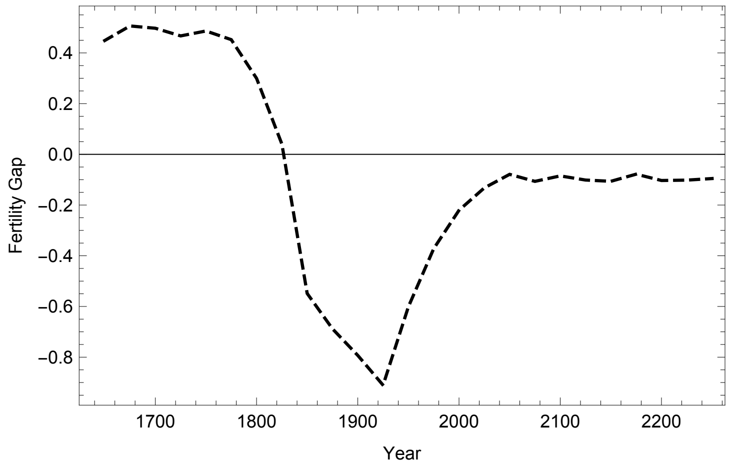


Figure 4: Fertility Gap

tance, requires that

$$\frac{\partial a_{t+1}^2/\partial R_{t+1}}{\partial a_{t+1}^1/\partial R_{t+1}} > \frac{1+\beta+\gamma\theta+\lambda}{1+\beta+\gamma\theta} = 1+\frac{\lambda}{1+\beta+\gamma\theta}$$

This is true so long as $1+\lambda/(1+p\beta+\gamma(1-\theta))$ that is, for all parameter values. Hence, the aspirational rich decrease their fertility at a faster rate than the non-aspirational poor. This intuition mostly carries over when productivity draws differ between the two groups of households. Figure 5 plots the implications of Figures 3 and 4 for overall population growth: the model replicates the overall fertility transition.

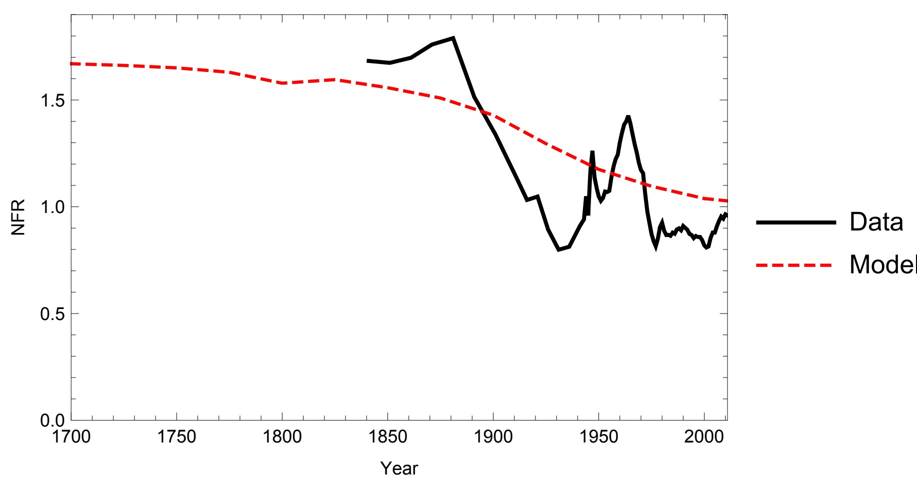


Figure 5: Fertility Transition

Finally consider the evolution of aspirations. The proportion of aspirational households steadily climbs during the Malthusian era (Figure 6) as the wealthiest have more children who are also

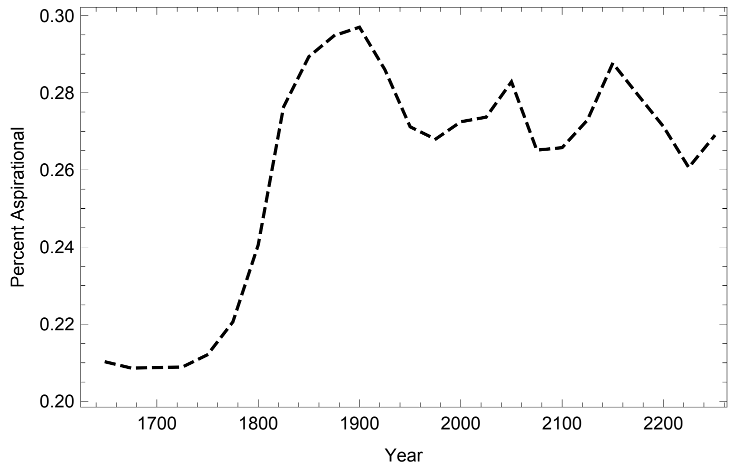
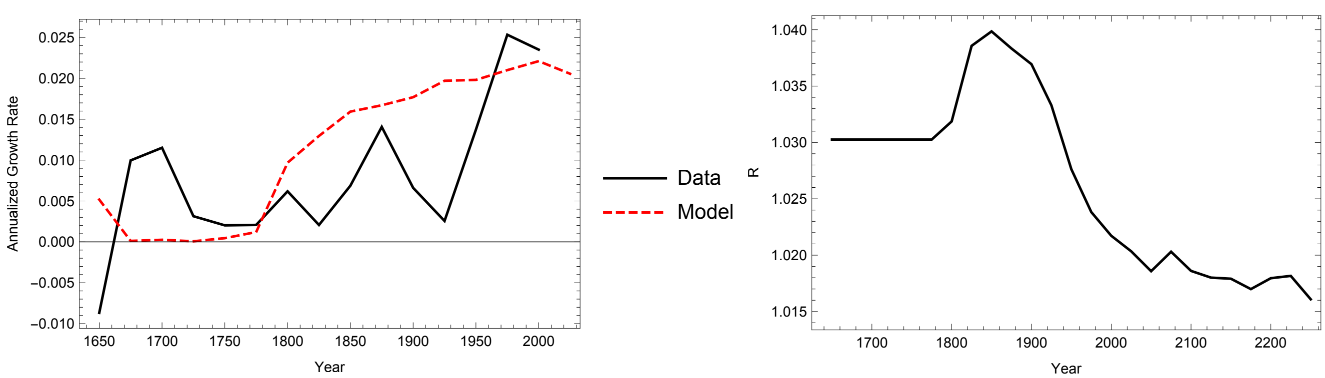


Figure 6: Proportion of Aspirational Households

more likely to behave aspirationally. At the onset of industrialization, however, the pattern reverses as the wealthy restrict their fertility while the poor continue to increase family size in response to rising wages. The initial reversal is partly undone as their rising number spurs more and more of these poorer households to become aspirational. The general implication of this result is that the more similar are people to each other, the easier it gets for the more successful to inspire the less successful. In the long-run the share of aspirational households stabilizes to slightly more than a quarter of the population.[15]

4.2.2 Economic Transitions

Figure 7 displays growth of output per capita (left panel) and the annual interest factor. Both in



(a) Log Output per Capita

(b) Annual Interest Rate

Figure 7: Log Output per capita and Annual interest rate

[15] Allen and Chakraborty (2021) show in related work that, as long as the aspirational motivation proxied here by λ and κ, is not too low, not everyone becomes aspirational in the long-run.

the model and data,[16] economic growth takes off in the last quarter of the eighteenth century as in Clark (2007, Figure 10.2). While the model does not capture well the pre-industrialization fluctuations, it does produce a similar increase in output per capita from capital deepening. Some of this deepening is due to the familiar wealth accumulation channel in the OLG model. Some of it is unique to this model. As Figure 6 indicates, during the pre-takeoff phase, the proportion of households who are aspirational steadily rises. These households are predominantly rich, have higher fertility rates and save a higher proportion of their income. This amplifies capital accumulation which, in turn, generate stronger knowledge spillovers that make the takeoff to modern economic growth possible. Note also that during the Malthusian phase, the result of capital deepening is more and more labor allocated towards cottage-industry production.

The trajectory of the economy after take-off broadly mimics the data. In this regard, the onset of industrialization and the rise of a specific pro-capitalist value, aspirations, is consistent with Clark's (2007) view of "survival of the richest" except the pre-industrial rich in our model happened to be so purely by luck of birth and ability. Moreover, as shown above, industrialization is carried forward by the behavior of the *less affluent* households that increasingly imbibe the pro-capitalist values favoring thrift, smaller family and greater investment in children.

Turning our attention to the interest rate, since the pre-industrial rate of return is calibrated, one test of the model is whether the economic and demographic transitions produced by the model are able to account for the decline of the interest rate in post-transition England. Here the model fits the secular decline reported in Clark (2007) and Schmelzing (2018) quite well. That the model produces a constant interest rate in the Malthusian era in Figure 7 is due to the labor-alone home production component of (11). That component pins down the wage rate and, through the capital-labor ratio, the interest rate. With the onset of industrialization, the model produces an initial increase in the interest rate. This is due to technological accumulation: when the economy begins to transition from the Malthusian to Modern era, increases in productivity and the labor force occur rapidly, however because of the non-convexities in this model (aspirational choice, bequests, etc.) capital accumulation does not initially keep pace and raises the interest rate temporarily. By the mid-1800s, however, interest rates plummet, first driven by the rise of aspirational behavior (see Figure 6), then by the mortality transition.

As we discussed before, Clark (2008) makes a compelling case for preference change based on the secular decline of the rate of return in England. The case is most easily seen in the context of the Ramsey model. For example, under logarithmic preferences, the long-run interest factor is pinned

[16]Data on this comes from "A millennium of macroeconomic data for the UK: The Bank of England's collection of historical macroeconomic and financial statistics" available at `https://www.bankofengland.co.uk/statistics/research-datasets`.

down by the subjective discount rate and growth rate of consumption per capital: $R = (1+g)/\beta$. A pre-transition $R = 1.05$ and zero annual growth implies $\beta = 0.94$. A post-transition $R = 1.02$ and annual growth rate of 1% requires $\beta = 0.99$. Ergo, we need a more patient population to reconcile a lower post-transition real return with faster economic growth.

Besides preference, in the two-period OLG model, the long-run real return to capital depends on production parameters, specifically, capital's share of output. Since savings is done out of labor income, a lower share of capital is needed to produce an abundant supply of capital, and lower rate of return. And, as in the Ramsey model, preference parameters that make the population future-oriented do the same. Though the subjective discount rate β in our model does not change, from Tables 1 and 2, the saving propensity depends on $p\beta$ which changes from the exogenous mortality transition and on the population's average λ that evolves endogenously based on aspirational behavior.

4.2.3 Counterfactuals

Preference Change

How essential is the emergence of pro-capitalist aspirations for these results? We return to the transition, this time setting $\lambda = 0$. First, consider the fertility transition in Figure 8. Aspirations

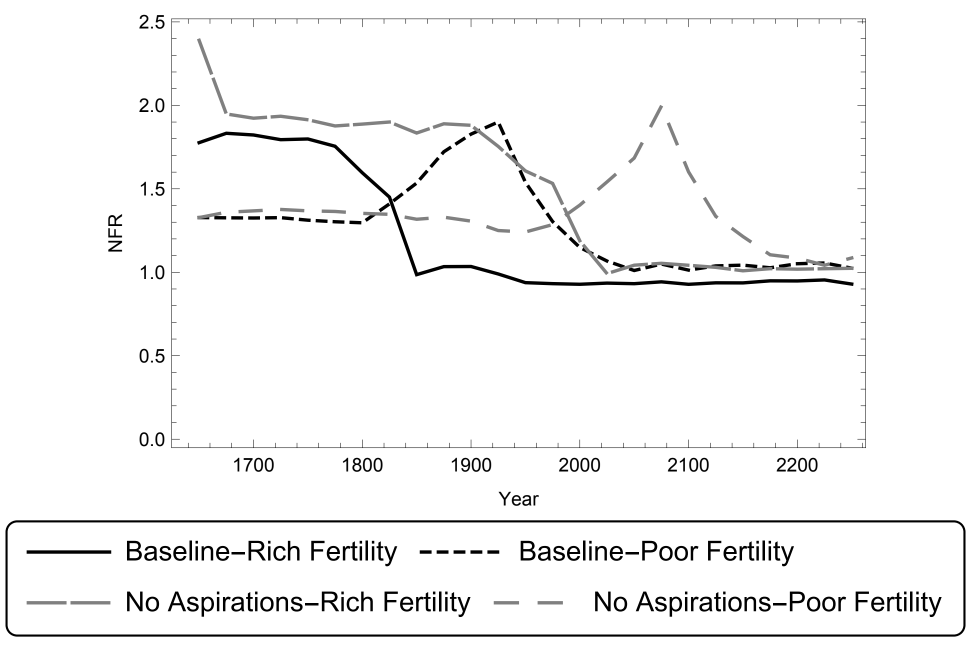


Figure 8: NFR: Aspirations vs. No Aspirations

clearly is important in predicting the timing of the transition. This is no surprise. The modern technology gets productive faster the more rapidly is capital accumulated; the absence of aspirations slows down productivity growth. Turning to the implications for the real return to capital, in Figure 9, the absence of aspirations does not attenuate the initial increase in R but has a significant effect on its eventual decline. The long-run (annualized) interest rate falls only marginally, to about 2.75%, in the absence of aspirations formation. Recall that in the simulations above we

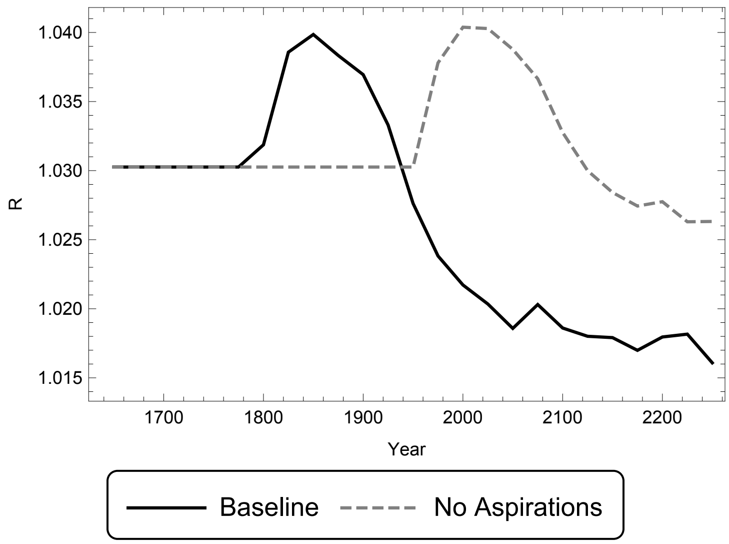


Figure 9: Return to capital with and without Aspirations

allowed adult survival to advance in sync with the mortality transition. Rising survival works similar to aspirations in making the population more patient over time but, unlike aspirations, affects rich and poor households alike. All of the decline in R in Figure 9 is driven by exogenous survival gains.

How relevant are these survival gains for the demographic transition itself? We hold the survival rate at its pre-transition value in 1780 and allow for aspirations formation ($\lambda > 0$). The conclusion from this experiment, shown in Figure 10, is that non-changing survival does not substantially affect the fertility transition. It does, however, affect long-run fertility. Holding late-life survival at its 1780 value means the population behaves less patiently and accumulates wealth more slowly. The latter slows down intergenerational transfers, weakens the quantity-quality tradeoff, and raises fertility.

Next we consider the joint effect of no-aspirations and no-mortality transition. This experiment has a bigger impact in Figure 11. The timing of the transition is delayed by six generations and the length of the transition increases by two generations. Given that the survival rate and aspirations both change the household's discount rate, this is evidently the effect of lower capital accumulation among households. When it comes to the real return to capital, Figure 12 shows that, as discussed before, the absence of preference and mortality change leaves only the capital

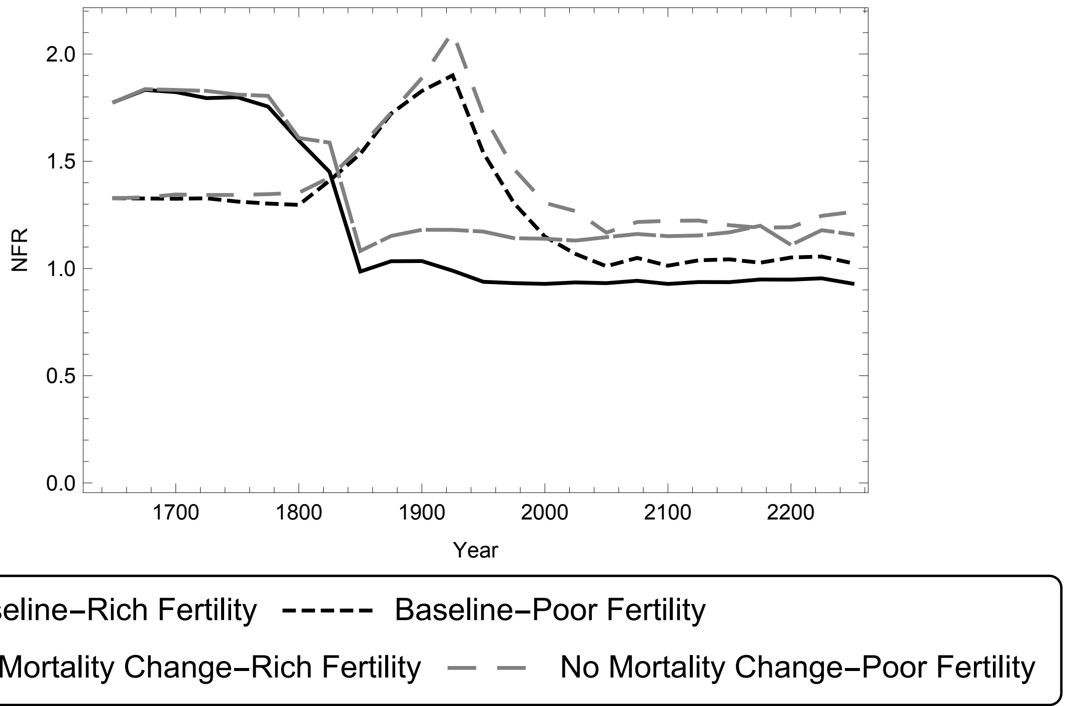


Figure 10: NFR: No Change in the Mortality Rate ($\lambda > 0$)

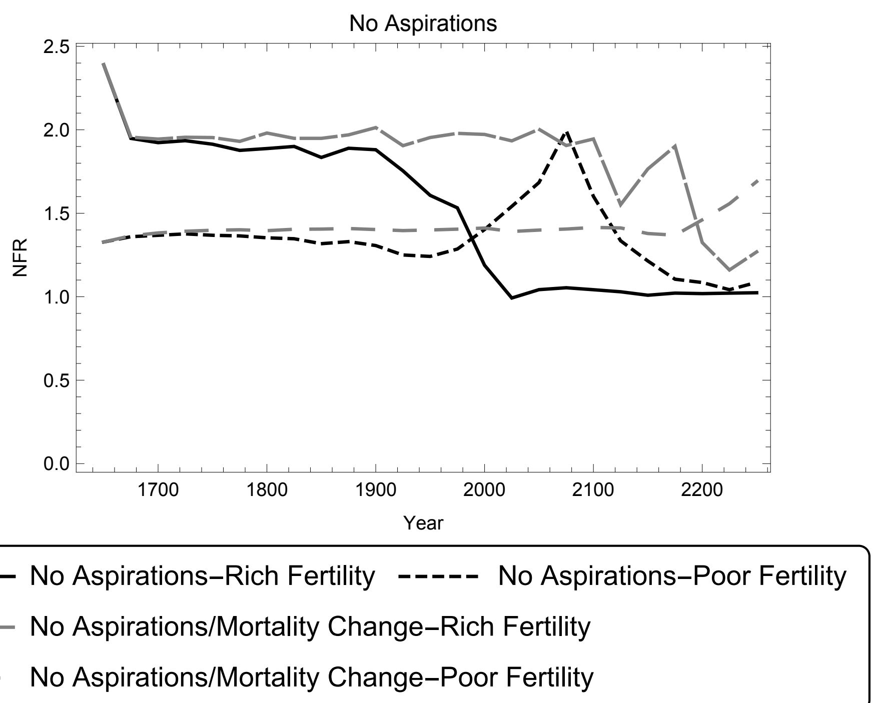


Figure 11: NFR: No Change in the Mortality Rate ($\lambda = 0$)

accumulation margin to affect the long-run return and here the increase in capital's share of output leads to a significantly higher return.

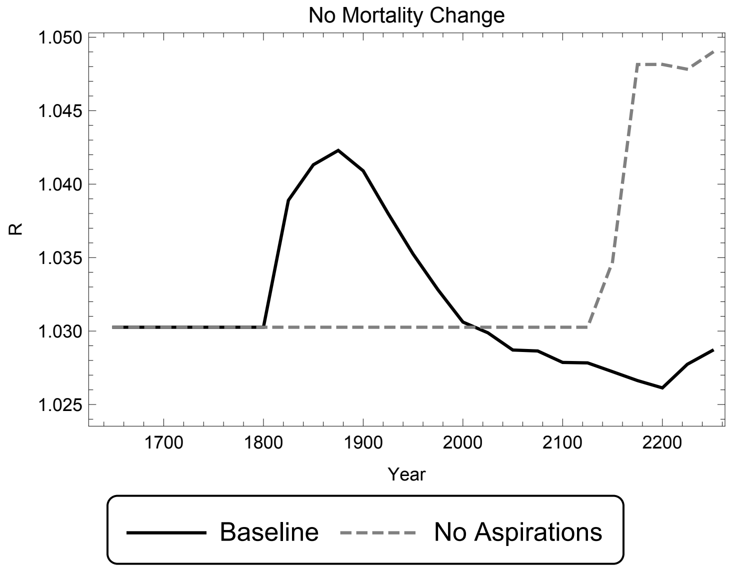


Figure 12: Return to capital with and without Aspirations, Unchanging Survival

Based on the results in Figures 8 – 12 above, we conclude that in the absence of aspirations, changes in mortality can drive enough capital deepening to kick off a transition (Figure 11), but in the presence of aspirations, mortality changes are secondary to changes in aspirational behavior, or what we have been calling, pro-capitalist preferences (Figure 10).

Intergenerational Transmission

The second set of counterfactuals we study has to do with intergenerational transmission. Some of this transmission occurs in the model endogenously, through the transfer of wealth that then influences savings, fertility, and aspirations decisions. Rest of the transmission occurs exogenously through the auto-regressive coefficient ρ of labor productivity in equation 4.

An obvious source of this intergenerational correlation is human capital, though Clark (2005) argues, for eighteenth and nineteenth century English transitions, human capital was was not quantitatively important. A second source is the ownership of assets that had an oversized role on economic decisions. For example, land would have conferred broader powers and privilege in English society historically beyond its standard economic returns. A third candidate for ρ is genetics. There is considerable skepticism, however, from commentators such as Bowles (2007), Solow (2007) and McCloskey (2008), that a small set of uniquely suited genetic traits would have explained the prosperity of the rich historically (or now). Moreover, mathematically, a value of ρ less than one, implies a shrinking role of genetic advantage over the course of a century or more.

Still, it is important to understand how crucial ρ is for our results. If it is, there is room to be skeptical of cultural and preference change arising purely from endogenous economic forces. We tackle this in two ways. First, we ask how the simulated fertility transition looks in the absence of intergenerational ability transmission. In Figure 13, the $\rho = 0$ case has the same productivity

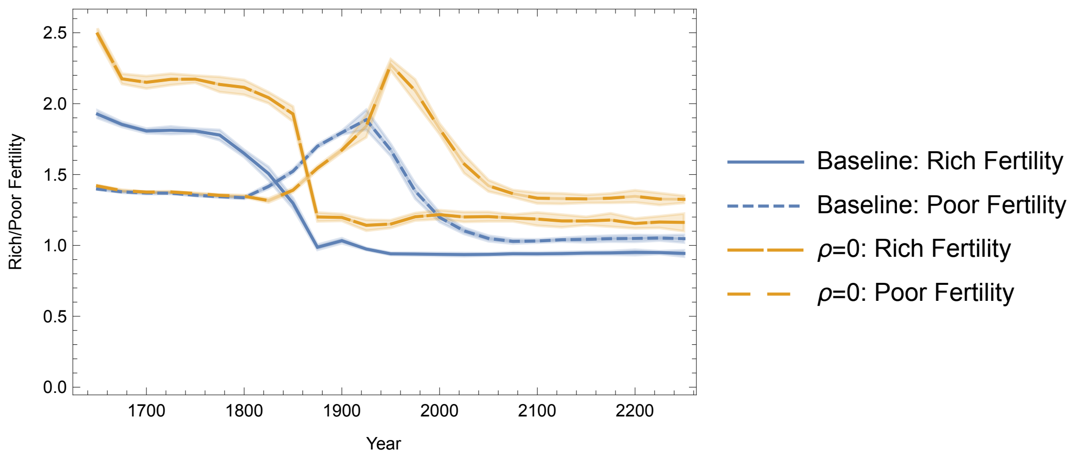


Figure 13: Fertility change for different values of ρ

distribution as the baseline $\rho = 0.75$ case. This is done by estimating the distribution of the productivity parameters for each period in the baseline case and feeding those parameters to the productivity distribution under $\rho = 0$; this ensures the same mean and standard deviation of productivity for each generation as the baseline model.[17] As the figure shows, the absence of intergenerational ability transmission has a small but meaningful impact on the fertility gap in the Malthusian era and higher fertility rates all across because of which long-run fertility is above replacement; the timing of the fertility transition itself is quite similar.[18]

A different way to study the relevance of ability transmission is to ask how important it is for cultural transmission itself. Specifically, how predictive is the ratio of child-to-parent productivity for the child's ability to choose their parent's type? Because the effect of this ratio would have a different sign for children going from non-aspirational to aspirational than aspirational to non-aspirational, we split the sample into aspirational and non-aspirational parents.

Few non-aspirational parents leave bequests during the Malthusian era. For this period, we ran

[17]In other words, the adjustment is to ensure comparable scaling and dispersion. For example, without the adjustment, mean productivity is lower for $\rho = 0$ which lowers capital accumulation and delays the onset and pace of the transition.

[18]It is important to note, however, that a more appropriate counter-example would have recalibrated the model under $\rho = 0$ to produce replacement fertility in the long run. That is after all the strategy followed in the baseline simulations.

a linear probability model regressing the productivity ratio on whether the child remained non-aspirational like their parent, controlling for parent's productivity.[19] During the Malthusian era, because non-aspirational parents tend to have low productivity, the average child was 42-43% more productive than their parent. Despite this, the average child of a non-aspirational household has an 89% chance of remaining non-aspirational. Even if the child were to be twice as productive, the chance is a high 82%. During the transition, there is less persistence in aspirations type given the structural change. In the long run, the persistence is again similar to the Malthusian era for children of non-aspirational households.

Next consider the case of aspirational parents. Because most of them leave bequests, their children differ in inherited wealth besides productivity. For the linear probability model, we control for parent's productivity as above and child's inherited wealth which has a direct impact on their aspirations choice. Since a simple comparison like the above is not feasible, consider how inherited wealth affects aspirations choice when the child's productivity is the same as parent's. For the top decile of the inheritance distribution, children of aspirational parents have a 94% chance of being aspirational. Even at the median decile, that chance is 79%.

Suppose instead we consider children with half the productivity of their parent. Then the chances of children being aspirational are high 86% and 75% for the top decile and median of the inheritance distribution.

The same question – how important ρ is for cultural change – can be assessed yet another way. Using the decision problem in equations (6a)-(6d), we compute the productivity cutoff for a child to switch from their parent's type. We then use this value to compute the probability – as a function of parental productivity[20] – that a child will remain their parent's type.

The left panel of Figure 14 shows this probability for non-aspirational parents, the right panel for aspirational parents. Children of non-aspirational households below the 60th percentile are 90% likely to be non-aspirational. In contrast, children of aspirational households above the 60th percentile are 90% likely to be aspirational. This allows us to discuss the relative importance of inherited wealth and labor productivity. First, we note that there is an asymmetry in how labor productivity is affecting cultural change: non-aspirational households exhibit significantly more persistence than aspirational households. What accounts for this? If we only consider the

[19] For example, being twice as productive as a low-productivity parent may not create as many opportunities as being so for a high-productivity parent. Results are similar without controlling for parent's productivity.

[20] We use parental productivity instead of inherited wealth for the following reasons. First, we note that since the sample is split between non-aspirational and aspirational households which means that inherited wealth is proportional to parental productivity. Thus, using parental productivity will give us the same percentile ranking as inherited wealth. Second, in the Malthusian era, a number of non-aspirational households leave zero bequests. Ranking on inherited wealth could leave two households with very different parental productivities next to each other, which would make our figures less smooth.

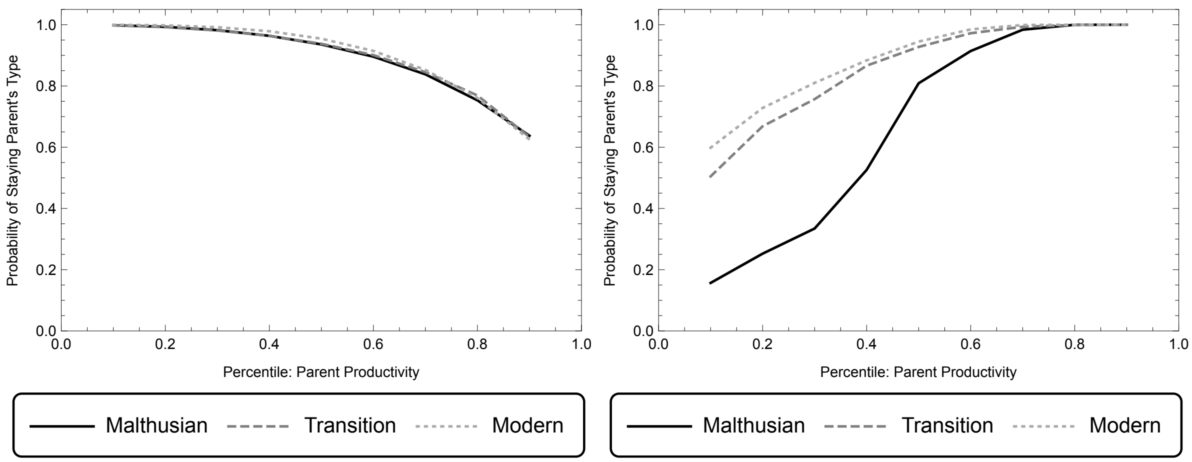


Figure 14: Productivity Cutoff for Switching Types: Non-Aspirational Parent (left) and Aspirational Parent (right)

Malthusian era, nearly all non-aspirational households leave zero bequests, which means that in order to switch from your parent's type you would need an improbably large productivity shock. What about less persistence for aspirational households? Across all three eras – Malthusian, Transition, and Modern – there is significantly more variation in inherited assets for aspirational households than non-aspirational. This makes children of aspirational households more vulnerable to negative productivity shocks across multiple generations. For example, consider three generations of households: grandparents, parents, and children. Suppose the grandparents are high productivity (top 10%) so they leave significant assets to the parents generation. Even if the parents receive a significantly negative productivity shock, based on Figure 14, they will remain aspirational because of their inherited assets. However, since the parents are low productivity, they transfer less assets to their children who then would require an improbably high productivity shock to remain aspirational. This is in contrast to non-aspirational households that leave fairly similar bequests across all levels of parental productivity.

In other words, while parental productivity plays a limited role in determining the child's aspirations type, that role is mainly relevant for the persistence of aspirational culture along a lineage and its relevance depends on intergenerational wealth transfers.

Taken together, these results say that intergenerational ability transmission plays a minor role in the emergence of a culture of aspirations; inherited wealth makes a bigger difference. Where it does have some effect, as determined by the counterfactual simulation above, is in accounting for overall fertility and the fertility gap between rich and poor households.

5 Conclusion

Using a tractable analytical model and quantitative work, we show here that the evolution of a pro-capitalist value like aspirations is quite capable of driving economic progress. The fundamental force behind this is the economic environment, the advantage conferred by family wealth and luck, instead of exogenously endowed cultural values that are particular to the rich.

Our theory, however, does not assess what it was about the English success that was particularly English. To the extent that the rich in other pre-industrial societies had higher reproductive success (Bowles, 2007), those societies too ought to have benefited from such socio-cultural forces. The early onset of industrialization in England then has to be due to a higher fertility gap between the English rich and poor compared to other societies (a topic that warrants further investigation) or conventional factors that provided an impetus to develop or implement new technologies. Any such alternative has to account for the secular decline in real rates of return that existing works in long-run development are unable to.

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