Occupational Choice and the Spirit of Capitalism*

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Abstract

The British Industrial Revolution triggered a reversal in the social order whereby the landed elite was replaced by industrial capitalists rising from the middle classes as the economically dominant group. Many observers have linked this transformation to the contrast in values between a hard-working and thrifty middle class and an upper class imbued with disdain for work. We propose an economic theory of preference formation in which both the divergence of attitudes across social classes and the ensuing reversal of economic fortunes are equilibrium outcomes. In our theory, parents shape their children's preferences in response to economic incentives. If financial markets are imperfect, this results in the stratification of society along occupational lines. Middle-class families in occupations that require effort, skill, and experience develop patience and work ethic, whereas upper-class families relying on rental income cultivate a refined taste for leisure. These class-specific attitudes, which are rooted in the nature of pre-industrial professions, become key determinants of success once industrialization transforms the economic landscape.

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1 Introduction

The Industrial Revolution was more than capital accumulation and growth. It also set off a social and political transformation that redefined hierarchies in society and reshaped the distribution of income and wealth. Before the onset of industrialization in eighteenth-century Britain, wealth and political power were associated with the possession of land. Over the course of the nineteenth century, a new class of entrepreneurs and businessmen emerged as the economic elite. For the most part, the members of this class rose from humble beginnings and had their social origin in the urban middle classes. The landed elite was left behind, and eventually lost its political and economic predominance.

Many observers of the time linked this reversal in economic fortunes to differences in values, attitudes, and ultimately preferences across social classes. There are countless examples, both in scholarly and fictional writing, of portrayals of members of the landowning class as averse to work, unwilling to save, ill-disposed to commercial activity, and unable to consider money as something to be profitably invested. In contrast, the new industrialists are described as frugal, thrifty, and hard-working.[1]

The role of values and culture as determinants of socioeconomic change is the subject of a long-standing debate in the social sciences. Karl Marx regarded economic relationships as the "base of society," and viewed culture, religion and ideology (the "superstructure") as mere reflections of the material interests of the class in control of the means of production. Max Weber reversed Marx's perspective, and argued culture and religion to be key driving forces in the development of modern capitalism.

In this paper, we develop a theory of preference formation that is rooted in the rational-choice paradigm, and ask whether such a theory can help explain the socioeconomic transformation that accompanied the Industrial Revolution. In our theory the link between economic conditions and cultural values (or, more precisely, class-specific preferences) runs both ways. On the one hand, differences in preferences across social classes are a key determinant of socioeconomic change. But on the other hand, these prefer-

[1]Adam Smith 1776 writes, for instance: "A merchant is accustomed to employ his money chiefly in profitable projects; whereas a mere country gentleman is accustomed to employ it chiefly in expense. The one often sees his money go from him and return to him again with a profit: the other, when once he parts with it, very seldom expects to see any more of it" (p. 432). In a study of early industrialists, Crouzet (1985) cites accounts of the time relating that Mancunian manufacturers of the late eighteenth century "... commenced their careers in business with but slender capitals. ... Patience, industry and perseverance was their principal stock" (p. 37).

ences and values are themselves shaped by the economic conditions that the members of different social classes face.[2] When applied to the Industrial Revolution, our theory predicts both the initial divergence of preferences across social classes and the ensuing reversal of economic fortunes as equilibrium outcomes.

We construct a model where altruistic parents strive to shape their children's preferences in a way that best fits with their future material circumstances. We focus on two key aspects of preferences: the rate of time preference (patience) and the taste for leisure (or, conversely, work ethic). Parental investments in patience interact with the steepness of lifetime income profiles. Lifetime earnings are relatively flat in some professions, while high returns are achieved only late in life in others, in particular those requiring the acquisition of skills. A parent's incentive for investing in a child's patience increases in the steepness of the child's future income profile. Conversely, a child endowed with high patience will be more likely to enter professions entailing the accumulation of skill and, hence, the delay of material rewards. Parental investments in their children's taste for leisure hinge on the role of labor effort. Parents who expect their children to be wholly reliant on labor income will tend to instill them with a strong work ethic, i.e., a tolerance for hard work and a reduced taste for leisure. In contrast, parents who anticipate their children to be rentiers with ample free time will teach them to appreciate refined leisure activities, from performing classical music to fox hunting.

The complementarities between patience and steep income profiles and between the taste for leisure and low work effort imply that, within a given dynasty, the choices of a specific occupation and of preferences suitable for that occupation are mutually reinforcing over time. As a consequence, even if the population is initially homogeneous, preferences gradually diverge across the members of different occupations. Hence, the society is endogenously stratified into "social classes" defined by occupations and their associated preferences and values. The theory also implies that the cultural divergence across social classes is related to financial development. If people can borrow and lend in perfect credit markets to smooth consumption, the link between occupational choices and consumption profiles is severed. Thus, divergence in patience across classes only emerges when financial markets are shallow, while financial development leads to more

[2]Although his work focuses mainly on the effects of culture on economic outcomes, Weber acknowledged the possibility of a two-way relationship and suggested, for instance, that religious factors may themselves be influenced by economic conditions: "It would also further be necessary to investigate how Protestant Asceticism was in turn influenced in its development and its character by the totality of social conditions, especially economic ... it is, of course, not my aim to substitute for a one-sided materialistic an equally one-sided spiritualistic causal interpretation of culture and of history" (Weber 1905, p. 183).

homogeneous societies. This prediction accords with the broad observation that class differences are less accentuated in modern industrial economies than in traditional societies.

The theory can account for the reversal in the economic fortunes of different social classes at the time of the Industrial Revolution. For centuries, members of the pre-industrial middle class—artisans, craftsmen, and merchants—had to sacrifice consumption and leisure in their youths to acquire skills. In response to this economic environment, the middle class developed a system of values and preferences centered around parsimony, work ethic, and delay of gratification. For the landed upper class, in contrast, neither work ethic nor patience were particularly valuable, because the members of this class could rely on fairly stable rental incomes from their estates. As a result, the landowning elite cultivated refined tastes for leisure and grew less future-oriented. In an otherwise stationary society, such differences in preferences and values had limited consequences. However, patience and work ethic became key assets—a "spirit of capitalism"—when opportunities of economic advancement through entrepreneurship and investment arose at the outset of the Industrial Revolution. In an already stratified society, it was members of the patient, hard-working middle class who made the most of the new opportunities and ultimately gained economic ascendancy over the landed elite.

While the theory predicts the triumph of the thrifty and hard-working bourgeoisie at the outset of the Industrial Revolution, it also implies that this success carries the seed of its own destruction. Whereas first-generation entrepreneurs started out poor, their descendants inherited the family business. The founders' children and grandchildren could thus rely on considerable capital income, making them less dependent on their own labor income. Just as for the landowners, this creates an incentive to invest in the appreciation of leisure: the industrial dynasties ultimately mimic the tastes of the old elite. In the extreme, this effect can lead to the downfall of a dynasty (the "Buddenbrooks" effect); at a minimum, the descendants will achieve less growth than the founders.

Our theory is consistent with a number of observations on the social history of Britain. For instance, well before industrialization, members of the upper class displayed a low propensity to save and accumulated debt, which suggests low patience. In addition, attitudes to work and leisure diverged over time between the pre-industrial upper and middle class. The perhaps most telling observation is that once economic success was achieved after the Industrial Revolution, the traditional middle-class work ethic gave way to an increased taste for leisure and an imitation of upper-class habits. This gentrification process ultimately lowered class barriers to the point where intermarriage between members of aristocratic and industrial dynasties became common fare.

Although we do not focus explicitly on religion, our theory is related to Weber's view that the spirit of capitalism was linked to the values of the Protestant Reformation. Protestant values, and especially Puritanism, were widespread among the urban upper-middle classes and may have been instrumental in their economic advancement. According to our theory, Puritanism was successful among these groups precisely because its values were compatible with the economic conditions faced by these groups. The same theory suggests that changing economic conditions should affect the success and popularity of religion. In line with this prediction, religious fervor among the middle classes declined in the late nineteenth century at the same time when the middle-class work ethic started to wane.[3]

In the following section, we relate our work to the existing literature. In Section 3 we analyze the decision problem at the heart of our theory in partial equilibrium. In Section 4, we embed the choice problem into a general-equilibrium model of a pre-industrial economy and discuss the evolution of the economy throughout the Industrial Revolution. Historical evidence and alternative theories are discussed in Sections 5 and 6, and Section 7 concludes. All proofs are contained in the mathematical appendix, which is available online.

2 Related Literature

Our work contributes to the recent literature on the economics of the Industrial Revolution (see Galor and Weil 2000, Hansen and Prescott 2002, Doepke 2004, and Clark 2007). As we do, Clark views changing values and preferences as a key element of the transition from a Malthusian era to a modern society: "As a whole these changes show societies becoming increasingly middle class in their orientation. Thrift, prudence, negotiation and hard work were imbuing themselves into communities that had been spendthrift, violent, impulsive and leisure loving" (p. 208). However, following Galor and Moav (2002), Clark emphasizes genetic selection rather than conscious investment

[3]This echoes Weber's discussion of the secularizing influence of wealth. Citing John Wesley, he writes: "Religion must necessarily produce both industry and frugality, and these cannot but produce riches. But as riches increase, so will ... the love of the world in all its branches ... Although the form of religion remains, the spirit is swiftly vanishing away" (Weber 1905, p. 175).

as the mechanism for preference formation (see also Clark and Hamilton 2006 and Galor and Michalopoulos 2006). We view selection and investment in preferences as complementary approaches, because they operate on different time scales and lead to distinct implications. The evolutionary literature is concerned with changes in the composition of genetic traits that affect entire populations and take place over long time horizons. Galor and Moav (2002), for instance, argue that selection pressures which generated preferences favorable for economic growth have been operating at least since the Neolithic Revolution nearly 10,000 years ago. In contrast, our focus is on the divergence of preferences across social classes, and our mechanism operates at a time scale from two or three generations (the "Buddenbrooks" effect) to at most a few centuries.

Our paper provides a new perspective of the effects of wealth inequality on development in the face of financial market imperfections. A number of existing theories point out that if financial markets are absent, poor individuals may be unable to finance otherwise profitable investment projects, and are therefore forced to enter less productive professions (see Banerjee and Newman 1993, Galor and Zeira 1993, Matsuyama 2006, and Bertocchi 2006). A common feature of this literature is that the rich, who are least constrained by credit market imperfections, generally do best and are the first beneficiaries of new investment opportunities. Therefore, these theories cannot explain how a new class of entrepreneurs rose from humble beginnings to leapfrog over the landed pre-industrial elite, at a time when wealth inequality was quite extreme and financial markets shallow by modern standards.

Our theory is also related to a recent literature on the effects of religious values on economic performance and the income distribution. Using international survey data, Barro and McCleary (2003) find that economic growth responds positively to the beliefs in hell and heaven. One interpretation of this finding is that a habit of contemplating the distant future generates individual behavior favorable for economic performance. Similar findings are documented by Guiso, Sapienza, and Zingales (2003).[4] In a different vein, Botticini and Eckstein (2005, 2006a, and 2006b) argue that Jews originally specialized in artisanship, trade, and finance because of religious reforms that fostered literacy among Jewish farmers. After the reforms, Jews progressively migrated to towns to exploit their comparative advantage in education in skilled urban occupations. Thus, as in our theory, group-specific values and attitudes have long-lasting effects on economic

[4]According to the calibration analysis of Cavalcanti, Parente, and Zhao (2007), differences in religious affiliation can explain some of the differences in the timing and diffusion of the Industrial Revolution across countries.

decisions. However, the impetus in Botticini and Eckstein is a cultural shock to a particular group (a reform in the Jewish religion), while our mechanism relies on economic incentives faced by an initially homogeneous population. Turning more specifically to Weber's hypothesis, Becker and Woessmann (2007) find that in nineteenth-century Prussia Protestant counties were more prosperous than Catholic ones. However, the effect of religion disappears when one controls for education, suggesting that values affect economic performance mainly through the accumulation of human capital. Although we do not model religion explicitly, our theory is consistent with this view.

The notion of patience as an asset that agents can invest in was first introduced in the economic literature by Becker and Mulligan (1997), who consider the problem of a consumer who lives for a finite number of periods and makes a one-time choice of a discount factor. In contrast, we embed the choice of patience in a dynamic model of preference formation with the additional dimensions of choosing an occupation and investing into the taste for leisure.[5] An alternative mechanism of preference transmission is advocated by the literature on cultural transmission (see Bisin and Verdier 2001, Hauk and Saez-Marti 2002, Saez-Marti and Zenou 2006, Fernández, Fogli, and Olivetti 2004, Gradstein 2007, Saez-Marti and Sjoegren 2007, and Tabellini 2007). As in our work, parents' incentives for forming their children's preferences depend on economic conditions. However, parents invest because they desire to make their children's behavior conform with their own wishes. In our dynastic model, parents judge their children's choices solely through the children's own eyes: preference formation is a gift that altruistic parents pass on to their children.

If patience and the work ethic are accumulated and transmitted within dynasties, parents' and children's propensities to save and invest should be positively correlated. This implication is confirmed by Knowles and Postlewaite (2004), who show that in the PSID parental savings behavior is an important determinant of their children's education and savings choices, after controlling for a variety of individual characteristics (see also Charles and Hurst 2003, who study the correlation of wealth between parents

[5]Also related are Mulligan (1997), where parents choose their own level of altruism towards their children, and Haaparanta and Puhakka (2003), where agents invest in their own patience and in health. Lindbeck and Nyberg (2006) focus on the negative effects of public transfers on parents' incentives to instill a work ethic in their children. Krusell and Stavlöt (2005) analyze the accumulation of a taste for culture consumption, and find that complementarities between current and future culture consumption can lead to multiplicity of steady states. The macroeconomic consequences of inherited (as opposed to chosen) preferences have been examined by de la Croix and Michel (1999, 2001) and Alonso-Carrera, Caballé, and Raurich (2007). In Artige, Camacho, and de la Croix (2004), inherited consumption habits can lead to the downfall of a temporarily wealthy country or region.

and children). Moreover, the correlation is stronger between children and mothers, who are usually more involved in a in child's upbringing than fathers. Our theory also posits that agents with steeper income profiles are more patient. This is consistent with the results of a field experiment conducted on Danish households by Harrison, Lau, and Williams (2002) showing that time discount rates of highly educated adults (who tend to have steeper income profiles) are about one third lower than those of adults with less education.[6]

Reyes-Garcia et al. (2007) study the effect of patience on economic outcomes among the Tsimanes, an Amazonian tribal society that only recently transitioned from self-sufficiency to a market economy. They find that more patient individuals were subsequently more likely to acquire formal education, choose market-oriented occupations, and earn higher income (see also Mischel, Shoda, and Rodriguez 1992). A recent empirical literature highlights the role of a broader set of non-cognitive skills, including both patience and work ethic, for economic performance (see Heckman and Rubinstein 2001, Segal 2004, and Heckman, Stixrud, and Urzua 2006). Coleman and Hoffer (1983) argue that the emphasis on patience and self-discipline is the key to the effectiveness of Catholic schools in the United States. This literature also shows that non-cognitive skills depend on nurture and family upbringing.[7]

3 A Model of Occupational Choice and Endogenous Preference Formation

In this section, we develop a theory of endogenous preference formation that is driven by parents' desire to instill certain tastes into their children. We concentrate on two dimensions of preferences, the taste for leisure and patience. Investments in the taste for leisure comprise all parental efforts that cultivate a child's ability to enjoy free (non-working) time. Examples are teaching one's child to swim, to play a sport, to ride a

[6]Other evidence of a positive correlation between steep income profiles and patience includes Carroll and Summers (1991), who document that in both Japan and the United States consumption-age profiles are steeper when economic growth is high, and Becker and Mulligan (1997), who show that consumption growth is high for adults who either have income themselves (which is associated with steep income profiles) or who had rich parents.

[7]See in particular Heckman (2000) and Carneiro and Heckman (2003), who review the evidence from a large number of programs targeting disadvantaged children. Similar conclusions are reached by studies in child development psychology such as Shonkoff and Philips (2000) and Taylor, McGue, and Iacono (2000). Dohmen et al. (2006) document evidence (based on the German Socio-Economic Panel) that trust and risk attitudes are transmitted from parents to children.

horse, or to play a musical instrument. Since a high appreciation of leisure raises the opportunity cost of working, parental efforts in the opposite direction (those that lower the taste for leisure) can be interpreted as increasing a child's tolerance for hard work. Parents may achieve this objective by preaching the virtues of an austere life.[8] Investments in patience determine the weight that a child attaches, in adult age, to utility late in life relative to the present. Instilling parsimony and thrift into children are examples of this type of investment. Religious ideas stressing the value of frugality and industry—the "Protestant Ethic" of Max Weber—can also be regarded as vehicles for the accumulation of patience and the work ethic.

In the theory, the parents' investments in their children's preferences respond to economic incentives. As a consequence, preference formation interacts with other economic decisions taken by both parent and child. Our particular focus is on the question of how preferences both determine and depend on the choice of an occupation. With an eye to our historical application, we separately analyze the decision problem of agents who rely on wage income alone (such as workers or artisans) and agents who also receive rents (such as landowners).

3.1 Preferences, Timing, and Occupations

The model economy is populated by overlapping generations of altruistic people who live for four periods, two as children and two as adults. People work throughout both adult periods (young and old), and their earnings may vary over time. Agents consume and make economic decisions only when they are adult. At the beginning of adulthood, every agent gives birth to a single child.

All adults have the same basic preferences. However, two aspects of the preferences are endogenous, namely patience (the relative weight of old versus young adult consumption in utility) and the taste for leisure (the marginal utility of free time). These taste parameters are determined during an agent's childhood as a result of her parent's child-rearing effort (i.e., investment in preferences). Once an agent reaches adulthood, preferences no longer change. An adult therefore takes her own preferences as given, but gets to shape her child's tastes.

Agents are altruistic towards their children. In addition, their utility depends on consumption, leisure, and investment in preferences in each of the two adult periods (see

[8] Formally, we only model parental investments in a child's taste for leisure; a parent who wishes to improve a child's work ethic would simply do little or none of this investment.

the time line in Figure 1). More formally, a young adult's lifetime utility is given by:

$$(1-B)\left(\log\left(c_1\right)+A\left(1-n_1\right)-l_{A,1}-l_{B,1}\right)+B\left(\log\left(c_2\right)+A\left(1-n_2\right)-l_{A,2}-l_{B,2}\right) \\ + z\, V_{child}(A'(l_A,A),B'(l_B,B)). \quad (1)$$

Here A denotes the taste for leisure, and B denotes patience. The first row of (1) is the adult's felicity: c_1 and c_2 denote consumption, n_1 and n_2 labor supply, and $l_{A,1}$, $l_{A,2}$, $l_{B,1}$, and $l_{B,2}$ the effort choices for investing in the child's taste for leisure and patience. To simplify the analysis, we assume that the investments in preferences are only productive if sustained at the same level over the two adult periods. Thus, $l_{A,1}=l_{A,2}=l_A$ and $l_{B,1}=l_{B,2}=l_B$. The second row of (1) is the altruistic component: V_{child} represents the child's maximized utility as a function of its preference parameters, as chosen by the parent. $A'(l_A,A)$ and $B'(l_B,B)$ are the "production functions" for the child's preferences, which take the form:

$$A'(l_A,A)=\psi\bar{A}+(1-\psi)A+g(l_A), \quad (2)$$

$$B'(l_B,B)=\psi\bar{B}+(1-\psi)B+f(l_B), \quad (3)$$

where $\psi\in(0,1]$ is a constant depreciation rate and f and g are non-negative increasing functions. $\bar{A}>0$ and $\bar{B}>0$ represent the innate levels of the taste for leisure and patience, i.e., the steady states of A and B in the absence of any investment. The intergenerational persistence of preferences captures the notion that, to some extent, children learn by imitating parental attitudes. Thus, part of the parents' preferences are transmitted effortlessly to the child. The parental effort is bounded, $l_A\in[0,\bar{l}_A]$ and $l_B\in[0,\bar{l}_B]$. Also, we normalize the time endowment to unity, $n_1\in[0,1]$ and $n_2\in[0,1]$, and impose the following restrictions.

Assumption 1 *The function $f:[\mathbf{0},\bar{\mathbf{l}}_B]\rightarrow\mathbf{R}^+$ is continuous, strictly increasing, and weakly concave, and $g:[\mathbf{0},\bar{\mathbf{l}}_A]\rightarrow\mathbf{R}^+$ is continuous, strictly increasing, and strictly concave. Moreover, $g(0)=f(0)=0$ and $f(\bar{l}_B)\leq\psi\left(1-\bar{B}\right)$. The parameters z and ψ satisfy $0<z<1$ and $0<\psi<1$.*

The assumptions imply the upper bounds for the preference parameters $A_{\max}\equiv\bar{A}+g(\bar{l}_A)/\psi$ and $B_{\max}\equiv\bar{B}+f(\bar{l}_B)/\psi\leq 1$.

3.2 Wage Earners

We first describe outcomes for agents who rely exclusively on labor income. In our historical application this will correspond to the landless classes, such as workers and artisans. In addition to choosing labor supply and investing in preferences, these agents choose an occupation. An occupation i is characterized by a wage (or labor productivity) profile $\{w_{1,i}, w_{2,i}\}$, where $w_{1,i}$ and $w_{2,i}$ are strictly positive and $w_{2,i} \geq w_{1,i}$ (due to a premium to experience and human capital). There is a finite number I of occupations to choose from. Occupations are indexed by $i \in \{1, 2, \ldots, I\}$, and ordered according to the steepness of the wage profile. Without loss of generality, we ignore occupations featuring a dominated profile.

Assumption 2 *The productivity profiles satisfy $w_{2,i} \geq w_{1,i} > 0$ for all i. Moreover, a higher index denotes a steeper productivity profile, i.e., $j > i$ implies $w_{1,j} < w_{1,i}$ and $w_{2,j} > w_{2,i}$.*

Since parents are altruistic towards their children and preferences are time consistent, the decision problem can be given a dynastic interpretation, where the head of the dynasty makes decisions for all subsequent generations.[9] In this section, we analyze the problem in partial equilibrium, taking the productivity profiles $\{w_{1,i}, w_{2,i}\}$ as exogenous and time invariant. In Section 4, we will extend the analysis to a general-equilibrium economy where the wage profiles are endogenously determined.

The development of financial markets plays an important role in our analysis. For now, we assume that financial markets are absent, i.e., households cannot borrow or lend to smooth out consumption. Hence, consumption is equal to income in each period, $c_1 = w_{1,i}n_1$ and $c_2 = w_{2,i}n_2$, and the preference parameters A and B are the only state variables for a dynasty. Later on, we will discuss the effects of financial development.

A young adult's choice problem can be represented by the following Bellman equation:

$$\begin{aligned} V(A, B) = \max_{i \in I, l_A, l_B, n_1, n_2} \Big\{ &(1 - B) \left(\log(w_{1,i}n_1) + A(1 - n_1)\right) \\ &+ B \left(\log(w_{2,i}n_2) + A(1 - n_2)\right) - l_A - l_B + z\, V(A', B') \Big\} \quad (4) \end{aligned}$$

[9]Note that discounting across generations is not a choice variable and depends on the exogenous altruism parameter z. It could be argued that investments in patience also affect altruism (i.e., z may be endogenous). Such a model would lead to qualitatively similar results, but the change would come at the cost of a loss of analytical tractability.

subject to (2) and (3). Our decision problem is a dynamic programming problem with two state variables on the compact state space $[\bar{A}, A_{\max}] \times [\bar{B}, B_{\max}]$. Standard recursive arguments imply that the Bellman equation (4) has a unique solution. Since A is constant over an individual's life, the optimal choice of labor supply in (4) is constant as well, i.e., $n_1 = n_2 = n$. This observation leads to a useful result: the problems of investing in patience and in the taste for leisure are separable.

Lemma 1 *The value function V is additively separable in its arguments, $V(A, B) = v_A(A) + v_B(B)$ where:*

$$v_A(A) = \max_{l_A, n} \{\log(n) + A(1-n) - l_A + z\, v_A(A')\}, \tag{5}$$
$$v_B(B) = \max_{i \in I, l_B} \{(1-B)\log(w_{1,i}) + B\log(w_{2,i}) - l_B + z\, v_B(B')\}, \tag{6}$$

subject to, respectively, (2) and (3).

Lemma 1 implies that as long as wages are the only source of income, the occupational choice does not interact with the investment in the taste for leisure, so that we can analyze the problems of investing in patience and in the taste for leisure separately.[10] We start by characterizing the value function $v_B(B)$, which reflects both the investment in patience and the choice of an occupation. The policy function for the investment in patience is denoted $l_B(B)$.

Proposition 1 *The value function v_B is non-decreasing, convex, and piece-wise linear. The steepness of the optimal wage profile, $w_{2,i}/w_{1,i}$, is non-decreasing in B, and the optimal investment in patience $l_B = l_B(B)$ is non-decreasing in B. Over the interior of any interval for B on which v_B is linear, the occupational choice of each member of the dynasty (i.e., parent, child, grandchild and so on) is constant and unique (though possibly different across generations), and $l_B(B)$ is constant and generically single-valued. Each kink in the value function corresponds to a switch to an occupation with a steeper income profile by a present or future member of the dynasty. At a kink, the optimal choices of occupation and l_B corresponding to both adjoining intervals are optimal. Thus, the optimal policy function is a non-decreasing step function, which takes multiple values only at a step.*

[10]The additive separability of the value function hinges on logarithmic utility. Since logarithmic utility is a common assumption in problems with endogenous labor supply, our analysis provides a useful tractable benchmark. The solution can be characterized under more general preferences if one abstracts from investment in the taste for leisure, see Doepke and Zilibotti (2005).

The value and policy functions are visualized in Figure 2. That v_B is non-decreasing follows from the assumption that the wage profile is non-decreasing. In particular, if for sufficiently low patience all members of a dynasty choose an occupation with a flat income profile ($w_1 = w_2$), the value function is constant in that range. This corresponds to the interval $[\bar{B}, B_1]$ in Figure 2. Within this range, the value function is flat (upper panel), and agents do not invest in patience (lower panel). As soon as B is sufficiently large ($B > B_1$), a current or future member of the dynasty finds choosing a profession with $w_2 > w_1$ optimal, and the value function becomes strictly increasing in B.

The convexity of v_B follows from a complementarity between patience and the choice of steep income profiles. To gain intuition, consider first the decision problem without an occupational choice, that is, with a fixed occupation $\{w_1, w_2\}$. If we vary the initial generation's B while holding the investment choice l_B constant over all generations, utility is a linear function of B (as depicted by the dotted line in the upper panel of Figure 2). Moreover, given the fixed income profile, choosing a constant l_B is optimal: the marginal return to investing in patience in a given period is given by $z \log(w_2/w_1)$, which does not depend on B. Generalizing from this observation, the value function is linear over any range of B such that it is optimal for the current and future members of a dynasty to hold the occupational choice constant. In general, however, occupational choices are not fixed. Given that B is the relative weight on utility late in life, it is optimal to choose an occupation with a steep wage profile (large i) when B is high, and one yielding a flat profile when B is low. As we increase B, the slope of the value function increases discretely every time either a current or a future member of the dynasty finds switching into a profession with a steeper profile optimal, resulting in a convex value function.

In the upper panel of Figure 2, the true value function is represented by the solid line; the points B_1 and B_2 are thresholds where either the current or a future occupation changes. At each of the kinks, some member of the dynasty is indifferent between (at least) two different profiles. As depicted in the lower panel of Figure 2, the optimal l_B increases at each step, because the marginal benefit of being patient increases with the steepness of the wage profile. Since the choice of l_B depends on the chosen income profile, there may be multiple optimal choices of l_B at a B where the value function has a kink, whereas in between kinks the optimal choice of l_B is unique.

Proposition 1 allows us to characterize the equilibrium law of motion for patience. Since the policy correspondence $l_B(B)$ is monotone, the dynamics of B are also monotone and converge to a steady state from any initial condition.[11]

Proposition 2 *The law of motion of patience capital is described by the following difference equation:*

$$B' = \psi \bar{B} + (1-\psi) B + f(l_B(B)),$$

where $l_B(B)$ is a non-decreasing step function (as described in Proposition 1). Generically, for any initial condition B_0 the dynasty converges to a steady state with constant B where parents and children choose the same profession. The steady-state levels of B and l_B are increasing in the steepness of the steady-state income profile. Multiple steady states are possible.

Since B_t converges to a steady state, there must be a time T such that the occupational choice of all members of a dynasty is constant from T onwards. The dynamics of B are particularly simple once the occupational choice is constant. Since the law of motion is given by $B_{t+1} = \psi \bar{B} + (1-\psi)B_t + f(l_B^{ss})$, patience converges to a steady state given by $B^{ss} = \bar{B} + f(l_B^{ss})/\psi$. However, the steady state does not have to be unique, even for a given B_0. For example, if the initial generation is indifferent between two different occupations, the steady state can depend on which one is chosen.

So far, we have established that members of different professions face different incentives for investing in patience, provided that the steepness of income profiles differs across professions. A key assumption underlying this result is that access to financial markets is limited. The incentive to invest in patience is determined not by the income profile *per se*, but by the lifetime profile of period-by-period utilities. If agents were able to borrow and lend within each cohort at a fixed interest rate, the interaction of patience and occupational choices would be severed: first, only occupations maximizing the present value of the lifetime wage profile would be chosen in equilibrium; second, since the household could freely allocate income among the two adult periods, the choice of a profession would have no bearing on the incentives to invest in patience. Put differently, at least some financial market imperfections are necessary for occupational choice and investments in patience to be interlinked.[12]

[11] If the production function for patience $f(l_B)$ is linear, in knife-edge economies (i.e., in a zero-measure subset of the parameter space) the policy correspondence is not single-valued even between steps. Convergence in terms of occupational choice is still guaranteed, but dynasties may be indifferent between multiple patience levels. In generic economies, $l_B(B)$ is single valued even in the linear case.

[12] It is not necessary, however, to assume the complete absence of financial markets, as we do for analytical convenience. As long as the steepness of an income profile is at least partially transmitted to

A positive implication of this finding is that the degree of preference heterogeneity in a population depends on the development of financial markets. In an economy where financial markets are mostly absent, incentives to invest in patience vary widely across members of different professions, and consequently we would expect to observe a large corresponding variation in actual acquired preferences. These differences should be smaller in modern economies with less imperfect financial markets.[13]

Consider, next, the problem of investing in the taste for leisure, as described by the maximization problem (5). The following proposition characterizes the value and policy functions $v_A(A)$ and $l_A(A)$.

Proposition 3 *The value function v_A is non-decreasing and convex. Optimal labor supply is given by:*

$$n = \min\{A^{-1}, 1\}. \tag{7}$$

The optimal investment in taste for leisure, $l_A = l_A(A)$ is non-decreasing in A.

More specifically, the value function is strictly increasing over any range of A where leisure is positive, i.e., $n < 1$ or, given (7), $A > 1$. The convexity of the value function is once again due to a complementarity between preferences and economic decisions befitting these preferences. The value function would be linear in A if people could not adjust their labor supply when A changes. However, people do adjust n (they work less when A increases), and the value function is thus convex. Unlike the choice of an occupation, n is a continuous variable, implying that the value function is strictly convex, except in ranges where n is at a corner. The characterization of v_A leads to the following results regarding the equilibrium law of motion.

Proposition 4 *The law of motion of the taste for leisure is described by the following difference equation:*

$$A' = \psi\bar{A} + (1-\psi)A + g(l_A(A)).$$

utility profiles, the basic mechanism is at work. The assumption of complete financial markets is routinely rejected even in contemporary data from industrial economies, see, e.g., Card, Chetty, and Weber (2007).

[13]For example, although engaging in a lengthy program of study (such as medical school) that leads to high future incomes may still require some patience and perseverance, today's students have access to educational loans and credit cards. Hence, the modern-day artisans are able to consume some of their future rewards already in the present, and consequently they (and their parents) face a smaller incentive to invest in specialized preferences.

Given an initial condition A_0 the dynasty converges monotonically to a steady state with constant A.

Multiple steady states are possible, depending on the parameterization of g. However, cross-dynasty differences in the taste for leisure can only arise from differences in initial conditions. If all dynasties start with the same A, they remain identical along this preference dimension. The incentive to invest into the taste for leisure depends entirely on the amount of leisure enjoyed by future members of the dynasty.

3.3 Rentiers

We now consider the choice problem for agents earning rents. In our historical analysis, this will correspond to the landowners. Unlike the landless wage earners, the landowners in our economy will not have to choose an occupation, because their income is provided by inherited land. However, they still have to make decisions on patience and the taste for leisure.

We denote the rent accruing per unit of land by r, and the amount of land owned by a given landowner by x. In order to appropriate the entire rent, landowners have to monitor the workers on their land. The landowners' budget constraints are

$$c_1 = \underline{r}x + (r - \underline{r})\, x n_1 \text{ and } c_2 = \underline{r}x + (r - \underline{r})\, x n_2,$$

where n_1 and n_2 denote the monitoring effort (in units of time) in the two periods. Even without monitoring (the proverbial "absent landlord"), the landowner earns a minimum return $\underline{r} < r$ on the land. By setting $n = 1$, landowners can appropriate the entire rent. Enjoying leisure entails a linear income loss. The return to monitoring is a reduced-form representation of moral hazard problems, such as the possibility that administrators steal a part of the rent. The key feature of this income process is that total income is less elastic with respect to labor effort than the income of pure wage earners.

Since the income profile is flat, optimal labor supply is constant, and the value function is independent of B. Thus, landowners do not invest in patience, and their investment and labor supply problem can be written as:

$$V^L(A, B) = v^L_A(A) = \max_{l_A, n}\{(\log(\underline{r}x + (r - \underline{r})\, xn) + A(1 - n)) - l_A + z\, v^L_A(A')\}, \qquad (8)$$

subject to (2).

Proposition 5 *The value function v_A^L is non-decreasing and convex. Optimal labor supply is given by*

$$n = \max\left\{\min\left\{A^{-1} - \frac{\underline{r}}{r - \underline{r}}, 1\right\}, 0\right\}. \tag{9}$$

The optimal investment in taste for leisure, $l_A = l_A^L(A)$ is non-decreasing in A. Given an initial condition A_0 the dynasty converges monotonically to a steady state with constant A, which is higher than the steady-state A for pure wage earners (as described in Proposition 4).

These results are parallel to Propositions 3 and 4, except that for a given A labor supply is lower than in the case of pure wage income, and decreasing in the ratio of the pure rent to the return to effort. This feeds back into the investment decision: parents whose children have more time for leisure invest more in the children's taste for leisure. Note that the incentives for landowners to supply labor and invest in the taste for leisure do not depend on the size of their estate, x: in steady state the entire class of landowners will have identical preferences. Over time, landowning dynasties earning rents will develop a higher taste for leisure (i.e., a lower work ethic) than dynasties relying on labor income only.

4 Preference Formation and the Industrial Revolution

In this section, we apply our theory to the evolution of preferences across social classes before and after the Industrial Revolution. As a first step, we embed our theory of preference formation into a general-equilibrium model of a pre-industrial economy. We show that even if everyone initially has the same preferences, general-equilibrium forces can lead to a stratification of society and divergence of preferences across social classes. Then, we explore how the economy evolves once the Industrial Revolution arrives in the form of new opportunities for investment and entrepreneurship.

4.1 The Pre-industrial Equilibrium

In the analysis of the previous section, the level of income derived in each profession has been taken as exogenous. We now endogenize wages and rental rates by constructing a simple general-equilibrium model of a pre-industrial economy characterized by two modes of production: agriculture and artisanship. Agricultural output, Y_F, and the artisans' production, Y_M, are perfect substitutes, so that total output is given by

$Y = Y_F + Y_M$. The two technologies differ in terms of the inputs used. The agricultural technology uses unskilled labor L and land Z, and is described by the following production function:

$$Y_F = L^{\alpha} Z^{1-\alpha}, \tag{10}$$

where $\alpha \in (0, 1)$. The artisan technology is linear in skilled labor H:

$$Y_M = qH, \tag{11}$$

where q is a productivity parameter. Both sectors are competitive, so that factors are paid their marginal product. The total amount of land is fixed at $Z = 1$. Land is not traded and is owned by a fixed measure of dynasties, each of whom owns an equal share x of land. The rents accruing to landowners depends on x and on their monitoring effort as discussed in the previous section. Each landowner bequeaths the land he owns to his child when he passes away. There is no occupational mobility between landowners and the other classes. The mass of landless labor-market participants (workers and artisans) is equal to one in every period.

The main difference between skilled and unskilled labor is the lifetime income profile. Recall that in equilibrium, all individuals relying only on labor income supply the same amount of labor n in both periods of their lives. An unskilled worker is equally efficient at young and at old age, and therefore supplies an equal number n of efficiency units of unskilled labor in both adult periods. Skilled workers (i.e., artisans), in contrast, use some of the young adult period to acquire skills and experience. Their effective labor supply is given by n efficiency units of skilled labor in the first adult period and by γn units in the second adult period, where $\gamma > 1$. Hence, artisans have a steep lifetime income profile, whereas the workers' profile is flat.

Suppose that initially the productivity q of artisanship is so low that only the agricultural technology is used. As a consequence, all landless agents are workers with flat income profiles. Patience is not a valuable asset in such an economy, and remains at the natural level $\bar{B}$. At this stage, all landless agents have the same preferences. Now consider the transition of the economy once the productivity of artisanship q increases unexpectedly. If the increase is sufficiently large, all workers remaining in agriculture is no longer an equilibrium. Thus, wages will adjust in general equilibrium to make everyone just indifferent between being a worker and being an artisan, and adults will endogenously divide between the two occupations.

Once the initial sorting of the landless agents into workers and artisans has taken place, stratification in preferences across social classes necessarily follows. In general, the transition can be complicated if the fractions of workers and artisans (and hence wages) change over time. Here we focus on equilibria such that, after the initial sorting, the number of workers and artisans remains constant and the wages are time invariant.[14] More formally, let μ be the aggregate labor supply in agriculture (that is, the fraction of workers among the landless adults multiplied by individual labor supply) after the sorting. Workers then earn a wage equal to $w_F = \alpha\mu^{\alpha-1}$ in both periods, whereas artisans earn q in the first and γq in the second period. If w_F is constant over time, the analysis of the preceding section applies directly to the decision problem in the general-equilibrium economy.[15]

The main feature of this equilibrium is that occupational sorting triggers divergence in patience across worker and artisan dynasties, even though in the first generation everyone has the same preferences. Given their steep income profiles, from the second generation onwards all members of the artisan dynasties are more patient than workers and strictly prefer to be artisans. In contrast, the taste for leisure is not affected by the occupational choice, because the members of both occupations continue to rely exclusively on labor income. Thus, the theory predicts no sorting across workers and artisans along this dimension of preferences, and both groups continue to work the same number of hours.[16] Land rents are constant in the equilibrium, so that landowners have a flat income profile and do not invest in patience. However, landowners invest more than artisans and workers in the taste for leisure, implying that their taste for leisure converges to a higher steady state.

To summarize, the members of the three occupations in our pre-industrial economy all end up with different preferences, shaped in each case by the economic conditions characterizing the profession. Both workers and artisans are hard-working, because they rely exclusively on labor income. Artisans are more patient than workers, however, since they face a steep lifetime income profile. The landowners face an income profile

[14]This focus is consistent with the observation that factor prices varied little in the pre-industrial economy. Clark (2007) shows that the wage of craftsmen relative to laborers in Britain were about constant between 1400 and 1800 (Figure 9.4). During the same period, land rents were a roughly constant share of income (Figure 7.4).

[15]An equilibrium with constant wages only exist for a subset of the admissible parameter set. A set of sufficient conditions is provided in the online technical appendix.

[16]This is consistent with the evidence presented by Voth (2000), who documents that the number of hours worked by workers and artisans in the pre-industrial era were approximately the same. See also the discussion in Section 5.

that is equally flat as that of the workers, and they consequently have the same low patience. Unlike the workers, the landowners derive their income mostly from land instead of labor. As a consequence, the landowners develop a higher taste for leisure (or conversely a greater aversion to work) than the landless classes. In the pre-industrial economy, this stratification of preferences is only important to the extent that it determines occupational choices. We now turn to the question how the fate of the different classes in our economy evolves when technological change alters the economic landscape.

4.2 From Artisan to Capitalist

We model industrialization by introducing a new technology that increases the productivity of savings and investments. The new technology becomes unexpectedly available after preferences have already diverged across classes. The class-specific preferences, which were formed in response to economic conditions in the pre-industrial period, also turn out to determine the extent to which members of different classes make use of the new technology. The basic result is unsurprising in the light of standard economic theory: the most patient and hardest-working classes, i.e., the artisans, are the first to take advantage of the new opportunity—they possess the "spirit of capitalism." The artisans leapfrog over the landowning class, and replace them as the economic elite. However, preferences continue to evolve after the introduction of the new technology. To some extent, this process can mitigate the subsequent divergence of wealth across classes. In particular, as the new industrialists accumulate wealth, they also start accumulating a taste for leisure. As a result, the children and grandchildren of the first industrialists are less economically successful than the founding generation.

After the introduction of the new technology, each dynasty faces a decision problem with three state variables: leisure taste A, patience B, and capital K. We interpret the capital variable as a family-owned enterprise. Young adults decide how much of their first-period income to consume and how much to invest into the family business. Investments in the business are assumed to be irreversible: agents can consume the output of the investment technology (as well as their labor and land-rent income), but the capital stock itself cannot be liquidated and turned into consumption. The capital owned by an old agent is bequeathed—up to depreciation—to her child.[17] We continue to assume that agents cannot borrow.

[17]Dynastic enterprises were common in the early days of the Industrial Revolution. Caselli and Gennaioli (2003) link this observation to the underdevelopment of financial markets: it was unprofitable for

The capital stock of the family business depreciates at the rate δ. The rate of return on capital depends on labor effort and is denoted by $R(n)$. Here the return is increasing in n, i.e., a hard-working entrepreneur earns a higher return than a passive owner. This captures the role of managerial effort and monitoring in a business and is parallel to our treatment of rental income from land. The return is given by:

$$R(n) = \underline{R} + (\overline{R} - \underline{R})n^{\eta},$$

where $\overline{R} > \underline{R} > 0$ and $0 < \eta < 1$.[18] We also assume that the business activity is run in addition to one of the existing professions. Thus, a young entrepreneur can derive additional labor income as a worker or artisan, or in the case of landowners, entrepreneurship can be combined with rental income from land. This feature, together with the absence of any fixed cost, allows businesses to be started at a small scale on top of other activities. In particular, we want to allow aristocrats to earn rents from their land and invest the proceeds in a capital market, so as to not exclude them from investment from the outset. For simplicity, we assume that a single effort choice determines labor or rental income as well as the return on the family business (separating these choice variables would complicate the notation without changing the main results).

Let $K \geq 0$ denote the bequest of capital received by a young adult. The budget constraints and the irreversibility constraint are given by:

$$c_1 + K' = (1 - \delta + R(n_{1,i}))K + y_1, \tag{12}$$

$$c_2 = R(n_{2,i})K' + y_2, \tag{13}$$

$$K' \geq (1 - \delta)\, K. \tag{14}$$

Here y_1 and y_2 denote income derived outside the family business. For workers and artisans, this consists of labor income ($y_1 = w_{1,i}n_{1,i}$ and $y_2 = w_{2,i}n_{2,i}$), whereas aristocrats receive the rents from their land x as a function of their monitoring effort ($y_1 = \underline{r}x + (r - \underline{r})\, xn_1$ and $y_2 = \underline{r}x + (r - \underline{r})\, xn_2$). In the budget constraint (12) for the first adult period, total income consists of y_1 plus capital income $(1 - \delta + R(n_{1,i}))K$. Because of

parents to liquidate their business instead of leaving it to the children. In our model, the irreversibility constraint implies that differences in investment across families lead to different initial assets for the next generation. Under reversible investment, similar results could be obtained if the altruism parameter z (the intergenerational discount factor) was an increasing function of patience B (the intragenerational discount factor).

[18] The curvature in the return function is not essential for the results, but is useful to generate a smooth relationship between state variables and the entrepreneurial return in the simulations below.

the irreversibility constraint (14), consumption cannot exceed the sum of current output and labor income: $c_1 \leq R(n_{1,i})K$. In the second-period budget constraint (13), the agent earns y_2 plus capital income $R(n_{2,i})K'$. Since the capital stock cannot be liquidated, the agent bequeaths the remaining capital $(1-\delta)K'$ to her child. [19]

The recursive representation of the decision problem of a young adult with leisure preference A, patience B, and inherited capital stock K is given by the following Bellman equation:

$$V(A,B,K) = \max_{c_1,c_2,l_A,l_B,n_1,n_2} \Big\{ (1-B)\left(\log(c_1) + A(1-n_1)\right) + B\left(\log(c_2) + A(1-n_2)\right) \\ - l_A - l_B + z\,V(A',B',(1-\delta)K') \Big\}$$

where the maximization is subject to the laws of motion for A and B (2) and (3), and the budget and irreversibility constraints (12), (13), and (14). Moreover, the choice variables are bounded by $c_1 \geq 0$, $c_2 \geq 0$, $0 \leq n_1 \leq 1$, $0 \leq n_2 \leq 1$, $0 \leq l_A \leq \bar{l}_A$, and $0 \leq l_B \leq \bar{l}_B$.

Capital investment affects the incentives for investing in both preference parameters, implying that the separation result of Lemma 1 no longer holds and the equilibrium laws of motion of A B and K are interdependent. This prevents a full analytical characterization, and the model must be solved numerically. Nevertheless, the basic tradeoffs that determine investment in preferences are still the same, so that, at least qualitatively, the interaction of capital accumulation and preference formation is easily understood.

First, consider how preferences determine the investment choice. Here a standard Euler equation applies: a young adult invests if future marginal utilities weighted by the appropriate time discount factors and investment returns exceed the cost of investing, i.e., current marginal utility. Thus, more patient agents have a higher propensity to invest. In addition, agents with a low taste for leisure also tend to invest more, since by working harder they earn a higher return on their investment. If we apply these findings to our economic environment, it follows that the artisans are, at least initially, the ideal investors, because they are both patient and hard-working. The other classes either invest less (relative to their income) or not at all. The latter would occur if an agent preferred

[19] In principle, parents could bequeath additional resources to their offspring. However, we focus on economies where the irreversibility of the capital stock is a binding constraint for the old adults. Namely, in the last period of their lives agents would like to liquidate part of the capital stock and consume it, but they are instead forced to leave it to their children as an involuntary bequest. Agents clearly do not leave any additional bequests in such economies. Formally, this outcome can be guaranteed by choosing the altruism factor z appropriately.

to borrow rather than save at the rate of return provided by the investment technology.

Once a family has entered entrepreneurship, this will feed back into the further evolution of preferences within the dynasty. Here the interactions with leisure preferences and patience are opposites of each other. In the case of patience, the fact that a dynasty starts investing will increase the investment in patience, which amplifies the original drive to invest. The reason is that investment endogenously steepens utility profiles both within and across generations, i.e., utility drops during the early investment period and increases in the later return periods.

However, this effect will be mitigated or even reversed by the endogeneity of the taste for leisure. The optimality conditions for labor supply and investing in leisure are unchanged; thus, labor supply depends on leisure preference as well as the elasticity of consumption with respect to labor effort, and investment in the taste for leisure depends on future labor effort. Initially, an artisan or worker dynasty entering entrepreneurship has little appreciation for leisure and is therefore hard working, as historically these dynasties relied on labor income alone. However, the descendants of the initial entrepreneurs inherit the family firm. Thus, just as the landowners', their consumption derives increasingly from capital income and becomes less elastic with respect to labor effort. As a consequence, the founders' children and grandchildren work less hard than their forefathers and develop the same fine tastes for leisure that the land-owning class already possesses. Of course, the drop in labor effort also lowers the return on investment, which can lead to a slowdown or even reversal in accumulation. Thus, the model verifies the "Carnegie conjecture:" the initial success of a dynasty can lay the seed for its ultimate downfall. Whether this effect dominates the increased accumulation of patience depends on parameters. This "Buddenbrooks" effect will be particularly strong if investment in the taste for leisure is highly elastic and labor effort has a large effect on entrepreneurial success, i.e., $\overline{R} - \underline{R}$ is large.

We now provide a numerical illustration of the equilibrium dynamics of our model after the introduction of a capitalist technology. Table 1 summarizes the parameter values used for the simulation. The functional forms for investing in the taste for leisure and patience are given by $g(l_A) = \phi_A l_A^{\xi_A}$ and $g(l_B) = \phi_B l_B^{\xi_B}$. As described in Section 4, the economy starts out under uniform preferences in the pre-industrial period long before the capitalist technology becomes available. Then people sort into professions, and over time preferences approach occupation-specific steady states. In this pre-industrial steady state, artisans earn a wage of 1.0 in the first and 2.0 in the second period, whereas workers earn a wage of $w \approx 1.4$ in each period.

Figure 3 displays the dynamics of capital and patience for members of the three occupations. The economy is still in the pre-industrial steady state in period 0; in period 1, the capitalist technology is introduced unexpectedly. Given the return of the investment technology, the workers continue not to invest in patience. The artisans, however, are sufficiently patient to find investment in capital attractive right away. Investment in capital increases the incentive for investing in patience, so that both the artisan's patience and their growth rate of capital increase for a few periods.

Figure 4 displays the dynamics of the taste for leisure during this transition. Once again, for the workers nothing changes. In contrast, as the artisan-turned-capitalist dynasties grow richer, their work ethic deteriorates. After a few periods, their taste for leisure is just as refined as that of the landowners. This contributes to a slow-down in their capital accumulation.

Given that the workers do not invest, the landowners *a fortiori* do not do so either. They have the same flat income profile (although possibly a higher income level) and the same low patience as the workers, but additionally a higher appreciation for leisure. They therefore continue to live off their land rents, and are soon overtaken by the rising class of capitalists as the economically dominant group in society.[20]

An interesting feature of the model is that the same pattern of catch-up and overtaking can also be generated in an environment where the investment technology is available from the outset, instead of being introduced later on. If all dynasties start out sufficiently impatient, initially the investment technology is not used. Some dynasties, however, sort into artisanship, and start to accumulate patience. After a few generations, the patience of the artisans reaches a critical level, at which they start to use the investment technology and turn into capitalists. In this version of the model, it is not the surprise appearance of a new technology, but the endogenous accumulation of patience capital that triggers the Industrial Revolution. Arguably, this sequence of events is closer in spirit to Weber's original hypothesis.

The outcome displayed in Figures 3 and 4 is extreme in that two classes choose to entirely exclude themselves from entrepreneurship, implying that wealth inequality grows

[20] In the model, all landowners are identical, so that there is not a single landowning investor. The separation of classes is less sharp if one adds preference shocks to the model. Then a few patient landowners can emerge who decide to utilize the new accumulation opportunity. These landowners would become quite rich, since they can earn income from both the industry and agriculture.

indefinitely. Other long-run patterns are possible depending on the parameters of the production function. The robust prediction of the theory is that the most patient and hard-working groups are the first to make use of a new investment opportunity. Even if the environment were such that ultimately even landowners invest, it is the middle class that would get a head start and possibly overtake the landowning class in the process.

5 Historical Evidence

In this section we document the basic historical facts underlying our theory, starting with the social origin of the first industrialists. In a study of founders of large industrial undertakings in Britain between 1750 and 1850, Crouzet (1985) concludes that "neither the upper class nor the lower orders made a large contribution to the recruitment of industrialists" (p. 68). The only class that was significantly over-represented among the industrialists was the middle class.[21] Similarly, Jeremy (1990) documents that in a sample of founders of large British businesses, among those born before 1870, the majority had "left school in their mid-teens or earlier and then started to learn a trade, most frequently by an apprenticeship" (p. 347). The minor involvement of landowners not only in the establishment, but also in the financing of new enterprises is surprising, given the extreme concentration of wealth in the hands of the landowning elite at the time. As late as 1880, fewer than 5000 landowners still owned more than 50 percent of all land (Cannadine 1990, see also Lindert 1981, p. 378). Commenting on the underrepresentation of the elite, Crouzet (1985) writes: "The contribution of that class to the industrial leadership is not proportionate to its large share in the nation's capital and income. Eric Richard has rightly asked of the great landed families: 'Why did they not do a great deal more in the Industrial Revolution? After all, no class was better placed to benefit from the transformation of the economy' " (p. 70).

Even the already low estimate of the share of peers and gentry among the industrialists overstates their true involvement in entrepreneurial activities. Landowners often became involved simply by virtue of owning the land on which an industrial activity was

[21] In the sample analyzed in this study, only 2.3 percent of the industrialists came from peerage and gentry (see Crouzet's Table 5). In contrast, 85 percent of the new industrialists had a middle-class background, with almost half of them coming from low-middle-class families, such as "shopkeepers, self-employed craftsmen and artisans, cultivators of various kind" (Crouzet 1985, p. 127). Although the upper class was a small group to begin with, the representation of the middle class was higher than that of the upper class even as a proportion of their share in the population. At the beginning of the nineteenth century, peerage and gentry accounted for about 1.4 percent of the population, while the middle class made up slightly less than 30 percent.

to take place. In the majority of these cases, the aristocrats had no active entrepreneurial role. "If they owned blast-furnaces, forges and other establishments, they tended to lease them to tenants rather than to operate them through salaried managers ... [They] were rather passive lessors and investors than active business leaders" (Rubinstein 1981, p. 68). Some became involved in the textile industries, but even those "were content to build—or help to build—mills and to lease them out" (Rubinstein 1981, p. 74). Similarly, those who became involved in the construction of mines and railways on their land usually insisted on receiving regular periodical payments over the sums invested, without any commitment to financing the growth of the enterprises. From the 1880s, an increasing numbers of aristocrats became board members of public companies. However, this step was taken only by the poorer members of the upper class. "Apart from Rothschild and Glenconner, all landowners who were company directors were indeed impoverished" (Cannadine 1990, p. 406–409).

The new class of industrialists progressively replaced the landed elite as the economically dominant group in society, as reflected, with some lag, in the wealth distribution. In the first half of the nineteenth century, large fortunes were still by and large associated with land ownership. Rubinstein (1981) reports that among the 189 individuals who died between 1809 and 1858 with a fortune exceeding one million pounds, 95 percent were wealthy landowners. However, merchants and industrial capitalists were already catching up. Lindert (1986, Table 1) documents that in 1810 the average estate of living gentlemen was more than three times larger than that of merchants and industrial capitalists, whereas in 1875 it was 16 percent smaller. Soon thereafter, landowners no longer featured prominently among the wealthiest families in the country. Between 1900 and 1939, only 7 percent of the 273 individuals who died as millionaires belonged to the landed elite (Rubinstein 1981, Tables 3.2 to 3.4.). Among the non-landed millionaires, about half of the new fortunes were generated in the manufacturing sector, with most of the rest accounted for by commerce and finance. The old elite managed to preserve a significant social and economic influence, partly through intermarriage with the new industrial dynasties.[22] Yet, the monopoly of political and economic power that this small elite had enjoyed for centuries was never to be restored.

Our theory attributes this transformation to class-specific preferences, which, in turn,

[22]Clark (2007, ch. 15) documents the story of the Sassoon family, whose founding member, David Sassoon, was a Sephardic Jew merchant born in Baghdad in 1792. By the 1880s the family had established several global enterprises, invested in India and China, and by the 1920s it owned more than one-tenth of the Bombay cotton industry. Several members of the family moved to England and were absorbed into the English aristocracy through marriages. See also Cannadine (1990), p. 347.

were shaped by the economic conditions in the pre-industrial period. Artisans and craftsmen, the typical professions of the pre-industrial middle class, were required to make large human capital investments, and consequently had steep lifetime income profiles. In most of Europe, an artisan's career advanced through three stages: apprenticeship, journeymanship, and mastership.[23] Apprenticeship would on average take five to six years, but in some professions one would remain an apprentice for up to 12 years (Epstein 1991). After apprenticeship, artisans would become journeymen and travel around European cities, serving as employees at some master's shop. This wandering period would last for a minimum of three to four years (Friedrichs 1995). Savings and frugality were essential for journeymen who hoped to become a master one day. "Unless he was able to count on substantial inheritance or fortunate marriage, a journeyman's primary interest was to amass capital for opening their shop or business" (Epstein 1991, p. 115). Having completed his time on the road, the journeyman could apply for admission to mastership, which was in itself an expensive process.[24] Only at that point, if successful, could the journeyman become a master and a new guild member, and open a shop at his own expense.

In contrast, the age-earnings profiles of agricultural workers and landowners were relatively flat. Burnette (2006) documents that the wages of English farm workers in the early nineteenth century varied little between the ages of 20 and 60. The landed gentry derived its income mostly from owning land and, to a smaller extent, from mining projects (Beckett 1986). Annual variation in a landowners' income stems from two dominant sources: fluctuation in land rental rates, and changes in the size of the estate through land sales or purchases. While there were always some economically successful families who were able to increase the size of their holdings, most aristocratic landowners merely aspired to preserve the estate, so as to ultimately pass to the next generation just as much as they once inherited. In periods of rising land rental rates, the income of landowners as a class would increase as well; but given that, with few exceptions, rents tended to change only slowly over time (at least until 1800), these movements would not

[23] The life of an apprentice was not glamorous. "Upon payment of a placement fee, apprentices took their place in their master's household, agreeing to obey and respect him as a father. ... Not all apprentices reached mastership, but this does not gainsay the fact that the purpose of apprenticeship was selection and the goal a direct route to mastership" (Farr 2000, p. 33).

[24] The applicants owed the payment of a series of fees, the completion of a masterpiece according to the guild regulations, and the outlay (if the masterpiece was accepted) for a luxurious banquet for the masters he hoped to join. In addition, he had to submit the name of a proposed bride, whom the guild was supposed to examine and approve. See Phelps Brown and Hopkins 1957, Munro 2004 and Farr 2000 for additional evidence.

generate the steep lifetime income profiles that were typical for artisans and craftsmen.[25]

In our theory, differences in economic conditions ultimately manifest themselves in class-specific preferences. And indeed, the stark contrast of the new entrepreneurs' thrift and work ethic with the landed aristocracy's free-spending habits and leisurely lifestyle has long been part of the conventional wisdom on the Industrial Revolution. The leisure orientation of the pre-industrial upper class was in fact one of its defining characteristics: the term "gentleman" traditionally signified a man who did not need to work. "Wealth and leisure allowed the aristocracy to develop a distinctive class culture that was reflected in the clothes they wore, the food they ate, their manners … and above all in their recreations" (Mate 2006, p. 279). Consistent with our theory, the aristocratic devotion to leisure grew more sophisticated over time. The social "London Season" had its origin in the sixteenth and early seventeenth centuries and expanded to involving as many as 4000 families in the late nineteenth century (see Cunningham 1990, p. 291). The countryside also saw an expanding range of leisure activities. Shooting, fox-hunting, and cricket all became fashionable upper-class sports in the eighteenth century, while yachting grew popular in the nineteenth century (see Cunningham 1990, p. 292 and Beckett 1986, p. 346). The available data show that the differences in work and leisure time between the upper and lower classes were quantitatively large. Voth (2000) documents that in a sample of Londoners in 1760 and 1800 the involvement of the elite in leisure activities was three to five times as large as that of other social groups, whereas there were no significant differences between the lower and the middle classes (Tables 3.23 and 3.24, p. 112–113).

In contrast, the middle class developed a strict work ethic and a growing disdain for leisure over time (Applebaum 1992). As pointed out by Weber, one source of this change was the Protestant Reformation. Unlike in medieval Catholicism, the glorification of God no longer required a contemplative attitude or a praise of poverty. Rather, eco-

[25]Real rents per acre in England were roughly constant between 1300 and 1600. In the early seventeenth century, real rents increased sharply, and then leveled off again until 1800 (see Clark 2007, Figure 14.2). In principle, a flat profile for overall family income need not imply that individual consumption profiles were flat as well. In particular, one might imagine that aristocrats started to consume heavily only after inheriting their estates, while living frugally during their younger years. However, the available evidence suggests that, if anything, the opposite was true. Young aristocrats typically did not work during their childhood and young adulthood and were supported by their parents. These family support payments tended to be large, and contributed to aristocratic indebtedness: "family payments were not the only cause of aristocratic indebtedness, but contemporaries usually regard them as playing a crucial role" (Beckett 1986, p. 298). Thus, aristocrats usually lived in some comfort during their entire lives and did not experience the stark contrast of a sober adolescence with relative prosperity during adulthood that was typical for urban artisans and craftsmen.

nomic success and an austere life became a way of glorifying God. "The summum bonum of this ethic, the earning of more money, combined with the strict avoidance of all spontaneous enjoyment of life ... is devoided of any eudaemonistic ... admixture" (Weber 1905, p. 53). Protestant values were also closely connected to the second element of our theory of preference formation, namely, patience or thrift.[26] Max Weber describes the effects of Puritan values on capital accumulation as follows: "When the limitation of consumption is combined with this release of acquisitive activity, the inevitable practical result is obvious: accumulation of capital through ascetic compulsion to save" (p. 172). Religious fervor was not, however, the only source of changing attitudes. According to Perkin (1969), after the Restoration of 1660 secular values such as social status and prestige also became increasingly tied to wealth accumulation and economic success. The first industrialists were especially imbued with this new ethic of patience and hard work. "Almost all major entrepreneurial figures took enormous risks, worked long and hard hours, and rarely enjoyed the fruits of their efforts until late in life" (Mokyr 1999, p. 41). Parsimony was particularly important because a large share of the new enterprises relied on personal savings and retained earnings to grow. "The early industrialists ... lived very modestly, spent only a fraction of their earnings for their households and put the rest back into the business" (von Mises 1963, p. 622).

To some extent, the reliance on retained earnings was feasible because, in most sectors, capital needs were relatively low during the first Industrial Revolution (see Mokyr 1999, p. 96). However, the shortfall of savings of the wealthy upper class has also been singled out as a contributing factor. For instance, Davis and Gallman (2001) write: "It may well have been true, as Postan noted, that at least two fifteenth-century families could have provided all the finance required to fund the entire Industrial Revolution. However, those (and other elite) families chose not to redirect their existing portfolios to meet either the relatively small demands of the manufacturing sector—demands that were met largely out of retained earnings—or much more importantly, the demands for supporting investment in infrastructure, particularly canal construction" (p. 50).

The lack of industrial investment is only one indication of the low patience of the upper class. If the members of the upper class were truly lacking in patience, they should have

[26]Work ethic and patience are important not only for investments but also for innovation, as witnessed by Edison's famous statement that invention is one percent of inspiration and ninety-nine percent of perspiration. Mokyr (1990, p. 241) argues that pre-industrial Britain benefited from the arrival of skilled workers fleeing anti-Protestant prosecution in France. Our theory suggests that this exodus may have fostered both the entrepreneurial spirit and the innovative capability that later on fueled the Industrial Revolution in Britain.

been unwilling to invest in other kinds of financial assets as well. The historical evidence supports this implication. Well before the Industrial Revolution, the British government became a major borrower, with multiple bond issues (mostly for war finance) throughout the seventeenth and eighteenth centuries. These bonds were mostly purchased by the urban middle classes, whereas the contribution of the landed classes was insignificant (Dickson 1967, p. 302). The financing of early public companies follows the same pattern. Bowen (1989) documents that most stockholders of the East India Company between 1756 and 1791 were "clergymen, bankers, military and naval personnel, officials, brokers, merchants large and small, and retailers," whereas "beyond doubt there was no large-scale investment in the Company by the landed interest or aristocracy" (p. 195). The pre-industrial elite thus played a surprisingly minor role in financing government borrowing and private enterprise well before the Industrial Revolution, despite being far wealthier than the middle class. This stands in marked contrast to the wealth elites in modern industrial countries, who generally own disproportionate shares of most types of assets, including government debt and public stock (see Carroll 2001 for evidence on the United States).[27]

Rather than investing the rents derived from their estates, many landowners used their land as collateral to borrow money. The scale of this borrowing substantially increased when long-term mortgage loans where introduced after the Glorious Revolution of 1688. Beckett (1986) reports that by the mid-eighteenth century "many families already had an accumulation [of debt] several generations old" (p. 300).[28] Money was usually borrowed not to finance improvement in existing estates or to buy more land, but to close the mismatch between expenditure and income:[29] "Rents and royalties were apparently being sucked into conspicuous consumption and frittered away in spiraling marriage contracts; and the gap between getting and spending was filled not by offloading assets such as land, but by borrowing from—in effect—the commercial, industrial and

[27]Notice that our theory does not posit that landowners were always impatient; in fact, the first aristocrats in a dynasty, who initially acquired title and estate, may have plausibly been particularly patient.

[28]See also Temin and Voth (2007).

[29]Thompson (1994) documents that ever since 1700, the landowners progressively withdrew from day-to-day involvement in the management of their estates. The investments and technical innovations in agriculture during the eighteenth and early nineteenth centuries, which played an important role in the British Industrial Revolution, were carried out almost entirely by tenant farmers. According to Cannadine (1994), most debt was taken on with the objective of "the enhancement of the social prestige and the fulfillment of the traditional responsibilities of the landowner. ... To the extent that such self-indulgent activities were financed from middle- and working-class savings, ... this definitely amounted to a 'haemorrhage of capital,' a 'misallocation of resources,' as funds from urban and industrial Britain were diverted to underpin the indulgence of the landed order" (p. 48–49).

shopkeeping members of the populace" (Beckett 1986, p. 316. See also Devine 1971, Kindleberger 1993, p. 175, and Porter 1982). Aristocratic indebtedness grew severely during the nineteenth century, and in 1847 an observer claimed that "between half and two-thirds of English land was encumbered (i.e. mortgaged)" (Beckett 1986, p. 315). Cannadine (1994) summarizes the situation as follows: "Whatever might have been the financial state of individual families, it seems clear that the landed aristocracy *as a class* was in debt through the first three-quarters of the nineteenth century" (p. 49).

Given our hypothesis of a low propensity to invest among the upper classes, one might wonder why the aristocracy did not simply sell land to middle-class buyers. One reason is that the land market in Britain was subject to pervasive legal restrictions that made selling land costly or even impossible. Most large estates were entailed, meaning that they could neither be split nor sold by the owner.[30] Mortgaging their land to merchants and banks was therefore the only way in which, *de facto*, many landowners could run down their assets. Eventually, after statutory reforms and changes in the common law eased the restrictions on land sales, many families overburdened by debt did sell off parts or all of their estates. By that time, the economic problems of the upper classes—aggravated by falling land rents after 1878—had become so pressing that land sales reached a massive scope. Cannadine (1990) summarizes the dismantling of aristocratic landownership during the first part of the twentieth century as follows: "The scale of this territorial transfer was rivaled only by two other landed revolutions in Britain this Millennium: The Norman Conquest and the Dissolution of the Monasteries" (p. 89). While other factors (taxation, decline of land rents) contributed to this final outcome, a clear thread links the chronic indebtedness of the landed aristocracy over centuries with its eventual decline and inability to hold on to the land.

Our theory predicts that the economic changes triggered by the Industrial Revolution should feed back on preferences. Among the thriving bourgeoisie, we should observe an increasing appreciation of leisure and ultimately a decline in economic success.[31] Indeed, social historians (see, e.g., Cunningham 1980) document a surge in the demand for leisure by the bourgeois middle class in the second half of the nineteenth century,

[30] Through the institution of entail, an aristocratic landowner could prevent his descendants from selling part or all of the estate.

[31] It should be noted, however, that our theory does not imply that the gentrified middle class will ultimately resemble the landed elite in all dimensions. In particular, unlike investing in the work ethic, the accumulation of patience is self-reinforcing over time and may lead to persistent cultural and economic differences between the classes. As in the example discussed in Section 4.2, industrial dynasties may continue to accumulate wealth, albeit at a lower rate, once the switch from work ethic to a heightened appreciation of leisure has taken place.

reflecting a waning of the austere values of the early days of industrialization: "At mid-century the Victorian middle class had been suspicious of the moral temptations of a beckoning leisure world, but had rapidly learned to assimilate it to their culture ... By the end of the century prescriptions had become more permissive—from 'Be virtuous and you will be happy' to 'Be happy and you will be virtuous'—and middle class leisure grew more expansive and assured" (Bailey 1989, p. 110). The changing preferences also affected other spheres of private and social life. To some extent, the appetite for consumption and leisure crowded out religion, in line with Weber's secularization hypothesis. Religious fervor, earlier a defining trait of the urban middle class, started fading in the second half of the century. Activities competing with leisure such as daily family prayers declined: "Remaining in the proper frame in mind ... when the smell of bacon and coffee assailed one's nose ... was too much for most of the younger generation and slowly the custom was shifted to once a week on Sunday evenings, and, as leisure activities for all age groups grew more varied, was finally abandoned" (Davidoff 1973, p. 35).[32] The new material experience of the middle class had ceased to be congruent with the rigid Puritan doctrine.

The change of values also affected the "industrial spirit," which according to Wiener (1981) started to decline after reaching its high-water mark with the Great Exhibition of 1851. At that time, many of the industrial dynasties underwent a process of gentrification and absorbed some of the values of the landed elite. "Sometimes successful industrialists left business altogether; other times they stayed in business, but viewed it ever more as a social duty rather than an economic opportunity" (p. 147). Florence (1953) argues that for the hereditary manager "the pecuniary incentive to large-scale expansion ... may be weak, since the family are [sic] already well-established. The transpecuniary objects are often stability and a conventional standard of life with plenty of leisure and long weekends devoted to sports and other gentlemanly pursuits rather than making one's way farther up the ladder" (p. 303, cited in Wiener 1981). Consistent with these changing preferences, we observe a waning of entrepreneurial success among en-

[32]Obelkevich (1990) summarizes the changing attitude of the middle class towards religious values as follows: "It was in the middle classes that the Victorian religious boom had the biggest impact ... In the 1870s the first signs appeared that the long period of growth was coming to an end. Though membership was still increasing, it failed to keep pace with the growth in the population, and church going actually began to decline: in middle-class districts in London attendance fell by more than a third between 1886 and 1902. Such hallmarks of Victorian religiosity as strict Sunday observance and family prayers were being abandoned ... Behind the statistics of falling attendances lay a deeper disaffection from the churches and their messages" (p. 338–346). The same author documents how the different churches responded by softening their message and precepts.

trepreneurial dynasties as family firms are passed on from the founding fathers to subsequent generations (the "Buddenbrooks" effect). In an empirical study of 1149 British business leaders born between 1789 and 1937, Nicholas (1999b) documents that "there is a comparatively low lifetime rate of wealth accumulation for firm inheritors. The older the dynasty, the lower is the rate of return. Third-generation entrepreneurs clearly underperformed relative to firm founders or managers" (p. 706–707). This observation is at odds with a purely genetic view of entrepreneurial skills and preference transmission.[33]

6 Discussion of Alternative Hypotheses

The mechanism outlined in this paper is not the only possible explanation of the changing fortunes of different social classes throughout the Industrial Revolution. A first alternative hypothesis is that the relative decline of the aristocracy was driven by changes in the value of land rather than the failure to embrace industrialization. Indeed, the crisis that started in the late nineteenth century coincided with a period of rapidly falling land rents. However, viewed over the entire industrialization period, rents increased substantially—arguably an effect of the growth in industrial production and the associated population boom—and the decline that occurred after 1878 only partially offset the earlier run up.[34] On the whole it appears as if the evolution of rents over time may have first delayed and then accelerated the economic decline of the landowning class, rather than being its ultimate cause. More generally, the robust prediction of our theory is a relative, but not necessarily absolute economic decline. Consistent with this prediction,

[33]The decline in the spirit of capitalism within industrial dynasties had already stricken contemporary observers. For instance, Alfred Marshall (1890) writes: "It would ... at first sight seem likely that business men should constitute a sort of caste; ... But the actual state of things is very different. ... [W]hen a man has got together a great business, his descendants often fail, in spite of their great advantage, to develop the high abilities and special turn of mind and temperament required for carrying it on with equal success. ... When a full generation has passed ... then the business almost invariably falls to pieces" (p. 299–300). A related argument is the "Carnegie conjecture," i.e., Andrew Carnegie's (1891) assertion that wealth "deadens the talents and energies" of children. Holtz-Eakin, Joulfaian, and Rosen (1993) provide evidence from the PSID that inherited wealth depresses labor supply. This is consistent with our model.

[34]According to Turner, Beckett, and Afton (1997), rents per acre tripled between 1790 and 1878 and fell by 27 percent between 1878 and 1910 (Table A2.1). Within the period, there were sharp increases between 1790–1815 (124 percent) and 1850–1878 (37 percent) and a period of flat rents in between. Clark (2007), who focuses on real rents per acre for farmland, reports a less pronounced increase and a sharper fall after 1878 (Figure 14.2). Nevertheless, the overall pattern is the same. One important factor that is associated with the evolution of land rents is the introduction of the Corn Laws in 1815 and their ultimate repeal in 1846. The effect of the Corn Laws on rents is controversial, though. For instance, Moore (1965) argues that they were not particularly effective in sustaining high agricultural prices. After the repeal of the Corn Laws, grain imports gradually increased, but rents actually increased over the following thirty years.

even during the period of rapidly rising rents the wealth growth of the aristocracy did not keep pace with that of new industrialists (as noted in the previous section).

Another hypothesis is that the upper classes were excluded from industrialization because urban workers possessed skills that were essential for industrial activities, while the landowners did not. For certain sectors and activities, there is indeed evidence that prior experience was important in determining who would become an entrepreneur.[35] However, when we consider the entire range of industrial activities the evidence suggests that differences in skills cannot be the only or main explanation. A significant share of the new industrialists had not previously been involved in any form of manufacturing. For instance, as many as 22 percent of the industrialists' fathers were yeomen and farmers, groups with no experience in industrial activity (Crouzet 1985). Moreover, there is evidence of substantial mobility across industrial sectors. Crouzet reports that no more than 40 percent of the fathers of the industrialists in his sample worked either in the same industry or in an industry or trade with forward or backward linkages with the branch in which they set up (Table 8, p. 152). Landowners were therefore not at a particular disadvantage in terms of their skills relative to many of the middle-class entrepreneurs. In fact, a number of key sectors during industrialization (such as mining, railways, and canals) required land as a major input. In these sectors, if anything, the landowners should have had an advantage over middle-class city dwellers.

A related argument is that the landowners, busy managing their rural estates, may have lacked the time and opportunity to enter industrial activities, which mostly took place in or near cities. However, many landowners did not actively manage their estates. Even more telling, it was not only the heirs of estates who shunned business activity; second and third sons of landowners did so as well. These younger sons had no choice but to enter some activity other than landowning, and were therefore not held back by their obligations to an existing estate. Nevertheless, they did not enter business in any larger numbers than their landowning fathers. For instance, consider Table 2, which reports the occupational choices of Cambridge graduates during the period 1750–1899. The vast majority of students at Cambridge during this period were sons of the landowning class, so their occupational choices (other than landowning) give us some idea of which professions younger sons entered.[36] Strikingly, until 1850, not a single graduate got

[35]Skills and experience in related activities were particularly important in the textile industry (see Crouzet 1985, ch. 8, p. 116–125, and also footnote 79, p. 206).

[36]One group missing here is those choosing the military career, who would attend a military academy instead of Oxford or Cambridge.

involved in banking or business (widely defined as any "profit-oriented activity"), and even after 1850 the percentage remains surprisingly low. This evidence is corroborated by the study of Crouzet (1985), who documents that few of the new industrialists' fathers were landowners (see footnote 21).

The arguments discussed so far do not rely on group-specific preferences. We now turn to explanations that do involve heterogeneity in preferences, but of a different nature than in our model. Cain and Hopkins (1993) argue that a social norm against the involvement in entrepreneurial activities excluded the British aristocracy from industrial capitalism: "A gentleman required income, and preferably sizeable wealth, but was not to be sullied by the acquisitive process" (p. 23). To the extent to which this exclusion was a matter of personal preference and (possibly acquired) taste, this thesis coincides with our explanation. However, as the classical theory of Veblen (1899) suggests, social norms may have also served as an instrument of social exclusion. A gentleman violating the norm would lose the recognition of his peers, with potentially grave consequences for social standing and access to aristocratic privileges. In this case, the enforcement would be partly extrinsic: even a gentleman enjoying hard work in principle may prefer to shun work in practice to avoid social sanctions. Interestingly, Veblen argued that the emphasis on leisure and refined tastes became a natural instrument of social exclusion precisely because the income process of the aristocrats granted them abundant free time, whereas members of other classes had no choice but to work: "Abstention from labour is the conventional evidence of wealth and is therefore the conventional mark of social standing; and this insistence on the meritoriousness of wealth leads to a more strenuous insistence on leisure" (Veblen 1899, p. 26). Thus, the social norm may have its roots in the same economic conditions that generate class-specific preferences in our theory.

The individual-preference and the social-norm approaches share many predictions for individual behavior, making it difficult to discriminate the two models empirically. One indication for the importance of individual preferences is that the "gentlemanly values" of the upper class persisted even after the aristocracy lost its predominance. If social norms had no function other than serving as an instrument of social exclusion, we would expect these norms to disappear once aristocratic privileges lost their value. The historical evidence suggests that aristocratic norms not only persisted, but even spread to other social classes throughout the nineteenth century.[37] This observation is inconsistent with an explanation for class-specific preferences based on social exclusion alone,

[37]When Britain went into economic decline relative to competitors such as Germany and the United States after 1870, much of the blame was placed on the British education system (in particular the public

because members of lower classes could not have gained access to social and economic privileges by merely imitating the tastes of the upper class.[38]

Perkin (1969) and Mokyr (1999) take the argument one step further and argue that acquiring gentlemanly status was an end to itself. In this view, both the initial accumulation of wealth and the later increase in leisure and ostentatious consumption can be interpreted as means to the end of first acquiring and later displaying social status. As in our interpretation, the economic slowdown of the industrial dynasties is a conscious choice, albeit for a different reason. While in our theory the increase in leisure is driven by a change in preferences, in Perkin and Mokyr it is part of the aristocratic ideal to which they had always aspired.

A last possibility is that aspects of preferences other than patience and leisure appreciation were driving the economic decisions of different social classes during the Industrial Revolution. For example, risk aversion or attitudes towards innovation may have also been relevant for the emergence of a spirit of capitalism, although these traits would apply mainly to entrepreneurship narrowly conceived rather than to the general attitude towards investments. Extending the analysis to these additional aspects of preferences may provide further insights. For instance, similar to the case of patience, financial development would tend to equalize the attitudes towards risk across dynasties engaged in different professions. However, it may induce parents to encourage risk-taking behavior in their children, contrary to the analysis of patience in this paper, where financial development reduces the incentive to invest in patience.

7 Conclusions

The modern theory of economic growth focuses on changes in material conditions and standards of living, while ignoring, with few exceptions, the role of culture. This approach is legitimate as long as culture, while possibly being shaped by economic conditions, does not feed back into economic decisions. Recently, however, a number of

schools and Oxbridge) for spreading aristocratic anti-business and anti-industrial attitudes to the upper middle classes; see the extensive discussion in Rubinstein (1993).

[38]While the industrial elite ultimately started to appreciate leisure, for the most part it did not acquire the main prerequisite of aristocratic privilege, i.e., land. For instance, Nicholas (1999a) notes that "those who made fortunes in business ... did not purchase or inherit land on large scale. This was despite the fact that their wealth gave them an unprecedented opportunity for land acquisition." Indeed, many preferred renting land for their leisure's sake, but did not bother with buying it. This suggests that leisure had intrinsic appeal to them, rather than being enjoyed solely for the purpose of social advancement (see also Rubinstein 1981, 1996).

economists have uncovered growing evidence that preferences, culture, and religion are important determinants of economic decisions and outcomes.

In this paper, we have developed a theory where economic conditions and culture are mutually interlinked. The theory can account for a number of observations about the British Industrial Revolution, such as the emergence of a spirit of capitalism among the urban middle class, as well as the subsequent replacement of the landed aristocracy by industrial capitalists as the socioeconomic elite. Consistent with evidence provided by social historians, the theory also predicts that the economic success of the bourgeoisie should ultimately lead to a cultural transformation of this class.

The theory shows that stratification of preferences across occupations may occur even in an initially homogeneous society. In reality, historical accidents may have fostered the stratification process. For instance, the political and religious forces behind the success of the Protestant Reformation may have contributed to the formation and transmission of preferences conducive to hard work and wealth accumulation. Likewise, demographic changes such as increasing longevity may have also played a role. A longer life horizon would tend to increase an agent's propensity to accumulate human capital and material wealth, reinforcing the effects of technological shocks at the time of the Industrial Revolution.

Although the analysis targets a specific historical episode, we expect the theory developed in this paper to be applicable to other open questions in macroeconomics and economic growth. For instance, a recent macroeconomic literature argues that preference heterogeneity is key for explaining portfolio choices and the dynamics of the wealth distribution in modern economies.[39] Our theory provides a new mechanism for the emergence and transmission of heterogeneous preferences. The theory also offers a new perspective on the impact of financial development on economic development. These and other aspects of endogenous preference formation are left to future research.

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[39]See Krusell and Smith, Jr. (1998), Browning, Hansen, and Heckman (1999), and Ameriks, Caplin, and Leahy (2003).

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Parameter	Interpretation	Value
z	Intergenerational Altruism	0.5
$\bar{A}$	Natural Taste for Leisure	1.0
ϕ_A	Level Parameter for Taste for Leisure	1.5
ξ_A	Curvature Parameter for Taste for Leisure	0.5
$\bar{B}$	Natural Patience	0.4
ϕ_B	Level Parameter for Patience	0.66
ξ_B	Curvature Parameter for Patience	0.5
ψ	Depreciation of Preferences	0.5
γ	Steepness of Artisan Income Profile	2.0
$\underline{R}$	Minimum Return of Capitalist Technology	0.35
$\overline{R}$	Maximum Return of Capitalist Technology	0.42
η	Elasticity of Entrepreneurial Return	0.5
δ	Depreciation of Capital	0.2

Table 1: Parameter Values for Simulated Economy

	1752–1799	1800–1849	1850–1899
Church	60	62	38
Land-Owning	14	14	7
Teaching	9	9	12
Law	6	9	14
Administration	3	1	6
Medicine	1	2	7
Banking	0	0	2
Business	0	0	5
Other	7	3	9

Source: Jenkins and Jones (1950), Table 1

Table 2: Professional Choices of Cambridge Graduates, in Percent

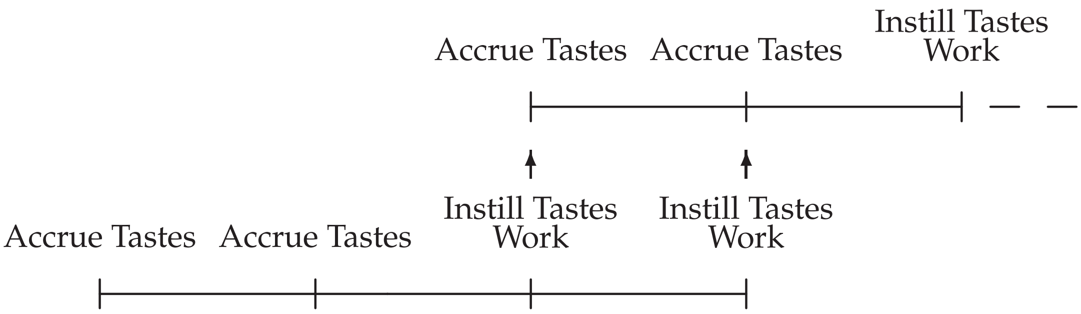

Figure 1: The Timing of Preference Formation and Labor Supply

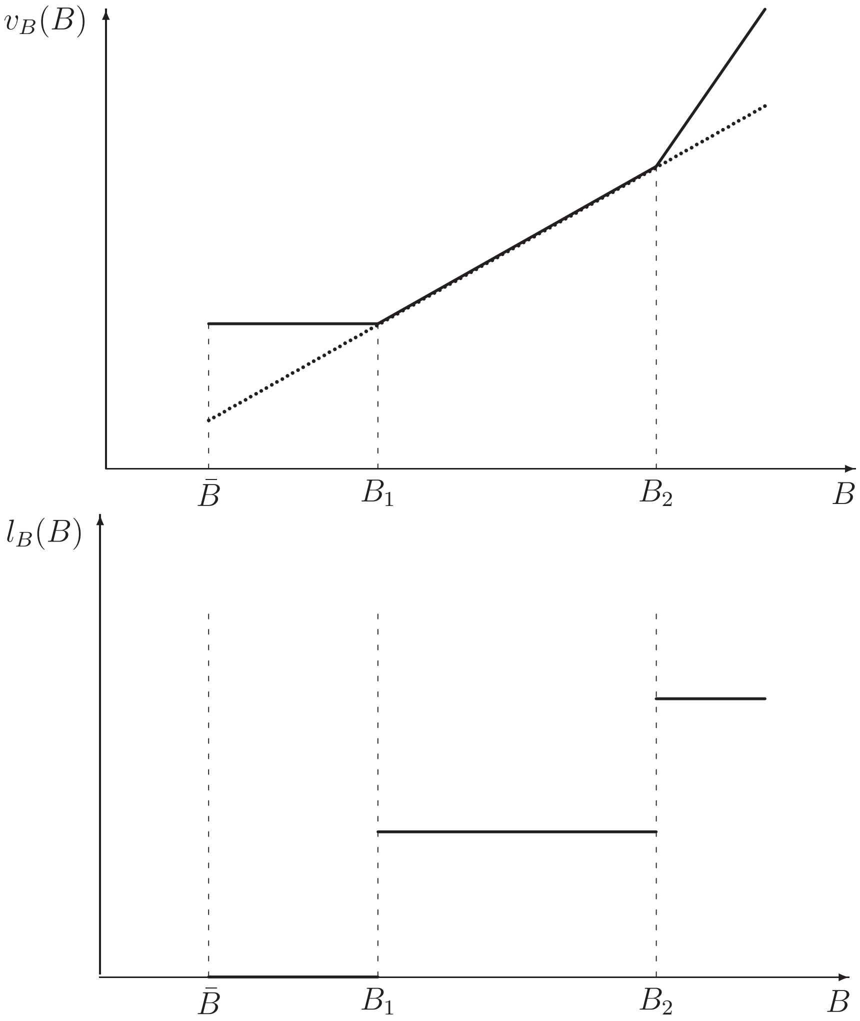

Figure 2: The Value Function for Patience $v_B(B)$ and Policy Function $l_B(B)$ for Investing in Patience

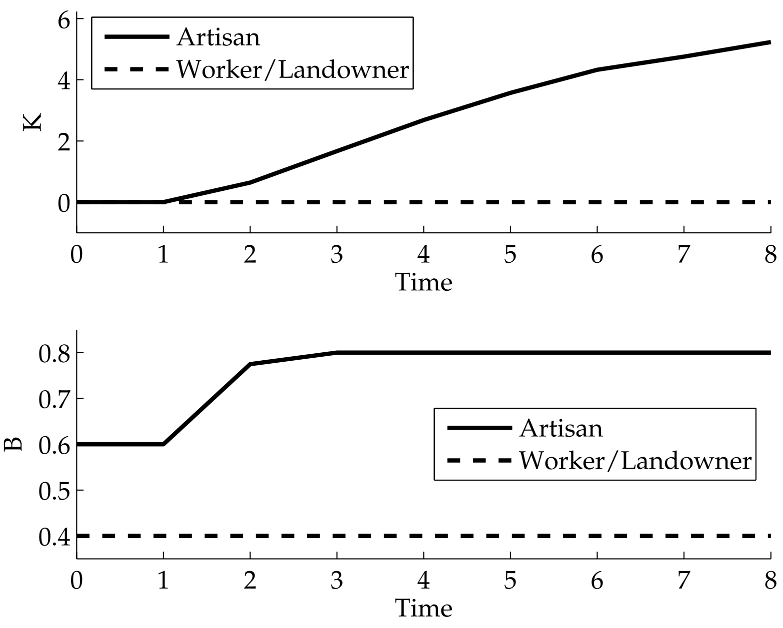

Figure 3: Capital Accumulation and the Evolution of Patience After the Introduction of a Capitalist Technology

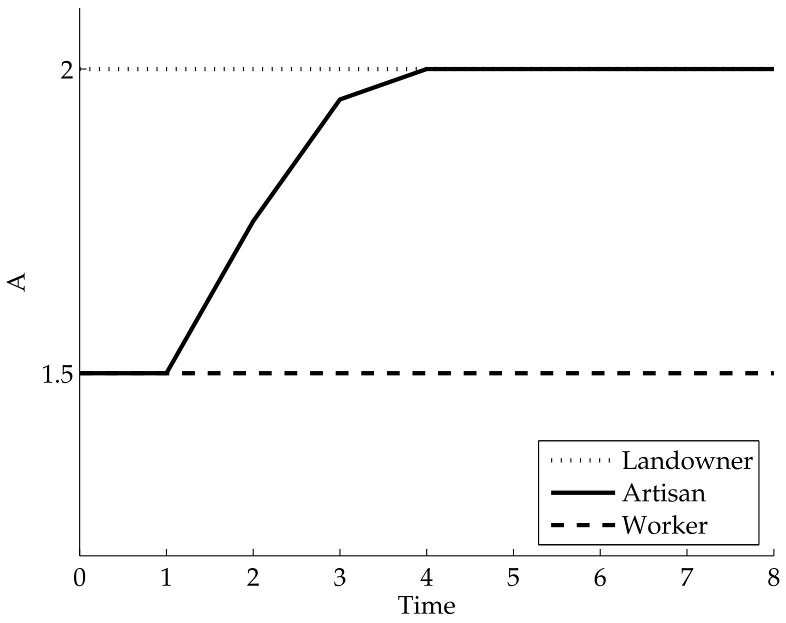

Figure 4: The Evolution of the Taste for Leisure After the Introduction of a Capitalist Technology

A Mathematical Appendix (to be published online)

Sequential Formulation of the Decision Problem:

The sequential decision problem corresponding to (4) is given by:

$$V^\star(A_0,B_0)=\max\left\{\sum_{t=0}^{\infty} z^t\big[\,(1-B_t)\log(w_{1,i\,t}\;n_{1\,t})+A_t\,(1-n_{1\,t})\right.$$
$$\left.+\,B_t\log(w_{2,i\,t}\;n_{2\,t})+A_t\,(1-n_{1\,t})-l_{A\,t}-l_{B\,t}\big]\right\} \quad (15)$$

subject to $i_t\in I$ $n_{1\,t}\in[0,1]$ $n_{2\,t}\in[0,1]$ $l_{A\,t}\in[0,\bar{l}_{At}]$ $l_{B\,t}\in[0,\bar{l}_B]$ $A_{t+1}=\psi\bar{A}+(1-\psi)A_t+g(l_{A\,t})$ and $B_{t+1}=\psi\bar{B}+(1-\psi)B_t+f(l_{B\,t})$.

Proofs for all Lemmas and Propositions:

Proof of Lemma 1: Given that optimal labor supply is constant ($n_1=n_2=n$), the value function (4) can be written as:

$$V(A,B)=\max_{i\in I,l_A,l_B,n_1,n_2}\big\{\log(n)+A(1-n)-l_A+(1-B)\log(w_{1,i})+B\log(w_{2,i})-l_B+z\,V(A',B')\big\}.$$

Thus, the return function is additively separable, which implies that the value function is additively separable as well. We therefore have:

$$V(A,B)=v_A\,(A)+v_B\,(B)$$

with:

$$\begin{aligned} v_A(A) &= \max_{l_A,n}\big\{\log(n)+A(1-n)-l_A+z\,v_A(A')\big\}\,,\\ v_B(B) &= \max_{i\in I,l_B}\big\{(1-B)\log(w_{1,i})+B\log(w_{2,i})-l_B+z\,v_B(B')\big\}\,, \end{aligned}$$

subject to, respectively, (2) and (3). Q.E.D.

Proof of Proposition 1: We start by establishing that the value function is unique, non-decreasing, and convex. The proof is an application of Corollary 1 to Theorem 3.2 in Stokey and Lucas (1989). The Bellman equation (6) defines a mapping T on the space of bounded continuous functions on the interval $[\bar{B},B_{\max}]$, endowed with the sup norm, where the mapping is given by:

$$Tv_B(B)=\sup_{i\in I,0\le l_B\le\bar{l}_B}\big\{(1-B)\log(w_{1,i})+B\log(w_{2,i})-l_B+z\,v_B(\psi\bar{B}+(1-\psi)B+f(l_B))\big\}\,. \quad (16)$$

Since we assume $0<z<1$, Blackwell's sufficient conditions for a contraction are met, and hence T has a unique fixed point by the Contraction Mapping Theorem. Using Corollary 1, we can now establish that the value function (i.e., the fixed point of the mapping T) is non-decreasing and (weakly) convex by establishing that the operator T preserves these properties.

To establish that the value function is non-decreasing, let v_B be a non-decreasing bounded continuous function. We need to show that Tv_B is non-decreasing as well. Choose two points

$B_h > B_l$ from the interval $[\bar{B}, B_{\max}],$. We want to establish that $Tv_B(B_h) \geq Tv_B(B_l)$. Since the right-hand side of (16) is the maximization of a continuous function over a compact set, the maximum is attained. Let $\underline{l}$ and $\{\underline{w}_1, \underline{w}_2\}$ be choices attaining the maximum for B_l. We then have:

$$\begin{aligned} Tv_B(B_h) &\geq (1-B_h)\log(\underline{w}_1) + B_h \log(\underline{w}_2) - \underline{l} + z\, v_B(\psi\bar{B} + (1-\psi)B_h + f(\underline{l})) \\ &\geq (1-B_l)\ \log(\underline{w}_1) + B_l\ \log(\underline{w}_2) - \underline{l} + z\, v_B(\psi\bar{B} + (1-\psi)B_l\ + f(\underline{l})) = Tv_B(B_l), \end{aligned}$$

which is the desired result. Here the first inequality follows because the choices $\underline{l}, \{\underline{w}_1, \underline{w}_2\}$ may not be maximizing at B_h, and the second inequality follows because v_B is assumed to be increasing, and we have that $(1-B_h)\log(\underline{w}_1) + B_h \log(\underline{w}_2) \geq (1-B_l)\log(\underline{w}_1) + B_l \log(\underline{w}_2)$ since $\underline{w}_2 \geq \underline{w}_1$.

To establish that the value function is convex, let v_B be a (weakly) convex bounded continuous function. We need to establish that Tv_B is also a convex function. To show this, choose a number θ such that $0 < \theta < 1$, let $B_h > B_l$, and let $B = \theta B_h + (1-\theta)B_l$. We now need to show that $\theta Tv_B(B_h) + (1-\theta)Tv_B(B_l) \geq Tv_B(B)$. Let l and $\{w_1 w_2\}$ be choices attaining the maximum for B. Since these are feasible, but not necessarily optimal choices at B_h and B_l, we have:

$$\begin{aligned} Tv_B(B_h) &\geq (1-B_h)\log(w_1) + B_h \log(w_2) - l + z\, v_B(\psi\bar{B} + (1-\psi)B_h + f(l)), \\ Tv_B(B_l) &\geq (1-B_l)\log(w_1) + B_l \log(w_2) - l + z\, v_B(\psi\bar{B} + (1-\psi)B_l + f(l)). \end{aligned}$$

Using these results, we have:

$$\begin{aligned} &\theta\, Tv_B(B_h) + (1-\theta)\, Tv_B(B_l) \\ &\qquad \geq \theta\left[(1-B_h)\log(w_1) + B_h \log(w_2) - l + z\, v_B(\psi\bar{B} + (1-\psi)B_h + f(l))\right] \\ &\qquad\quad + (1-\theta)\left[(1-B_l)\log(w_1) + B_l \log(w_2) - l + z\, v_B(\psi\bar{B} + (1-\psi)B_l + f(l))\right] \\ &\qquad = (1-B)\log(w_1) + B\log(w_2) - l \\ &\qquad\quad + z\left[\theta v_B((1-\psi)B_h + f(l)) + (1-\theta)v_B(\psi\bar{B} + (1-\psi)B_l + f(l))\right] \\ &\qquad \geq (1-B)\log(w_1) + B\log(w_2) - l + z\, v_B(\psi\bar{B} + (1-\psi)B + f(l)) = Tv_B(B), \end{aligned}$$

which is the desired condition. Here, the last inequality follows from the assumed convexity of v_B. The operator T therefore preserves convexity, and thus the fixed point must also be convex.

Next, we would like to establish that the steepness of the optimal wage profile as well as the optimal investment in patience are non-decreasing in B. To this end, choose two patience levels $B_h > B_l$, and let the corresponding optimal choices be $\bar{l}, \overline{w}_1, \overline{w}_2$ and $\underline{l}, \underline{w}_1, \underline{w}_2$. We want to prove that $\bar{l} \geq \underline{l}$ and $\overline{w}_2/\overline{w}_1 \geq \underline{w}_2/\underline{w}_1$. Consider first the steepness of the income profile. Optimization in the choice of the income profile implies the following inequalities:

$$\begin{aligned} (1-B_h)\log(\overline{w}_1) + B_h \log(\overline{w}_2) &\geq (1-B_h)\log(\underline{w}_1) + B_h \log(\underline{w}_2), \\ (1-B_l)\log(\overline{w}_1) + B_l \log(\overline{w}_2) &\leq (1-B_l)\log(\underline{w}_1) + B_h \log(\underline{w}_2). \end{aligned}$$

Subtracting the two inequalities yields:

$$(B_h - B_l)\log((\overline{w}_2) - \log(\overline{w}_1)) \geq (B_h - B_l)\,(\log(\underline{w}_2) - \log(\underline{w}_1)).$$

or:

$$\frac{\overline{w}_2}{\overline{w}_1} \geq \frac{\underline{w}_2}{\underline{w}_1},$$

which is the desired condition.

Optimization in terms of the investment l implies the following inequalities:

$$-\bar{l} + z\, v_B(\psi \bar{B} + (1-\psi)B_h + f(\bar{l})) \geq -\underline{l} + z\, v_B(\psi \bar{B} + (1-\psi)B_h + f(\underline{l})),$$
$$-\bar{l} + z\, v_B(\psi \bar{B} + (1-\psi)B_l + f(\bar{l})) \leq -\underline{l} + z\, v_B(\psi \bar{B} + (1-\psi)B_l + f(\underline{l})).$$

Subtracting the inequalities yields:

$$\begin{aligned} &v_B(\psi \bar{B} + (1-\psi)B_h + f(\bar{l})) - v_B(\psi \bar{B} + (1-\psi)B_l + f(\bar{l})) \\ &\qquad \geq v_B(\psi \bar{B} + (1-\psi)B_h + f(\underline{l})) - v_B(\psi \bar{B} + (1-\psi)B_l + f(\underline{l})). \end{aligned}$$

Given that f is increasing and v_B is increasing and convex, it follows that we must have $\bar{l} \geq \underline{l}$.

Given that we have established that the steepness of the optimal income profile w_2/w_1 and the optimal choice of investment in patience $l_B(B)$ is increasing in B, it follows that the patience and the steepness of the income profiles of all future members of a dynasty (child, grandchild etc.) are increasing in the patience of the current member of a dynasty as well.

Since there are only finitely many occupations, we can subdivide the state space $[0, B_{\max}]$ into finitely many closed intervals (they are closed because of our continuity assumptions in Assumption 1), where each interval corresponds to the choice of a given occupation i. The agent is just indifferent between two occupations at the boundary of two such intervals, and strictly prefers a given occupation in the interior of such an interval. The intervals can be further subdivided according to the occupational choice of the child. Since $l_B(B)$ may not be singled valued, there may be multiple optimal B' corresponding to a given B today. Nevertheless, since the B' are strictly increasing in B and given that there are only finitely many occupations, we can once again subdivide today's state space in finitely many close intervals, each one corresponding to a specific occupational choice of the child, such that the intervals overlap only at their boundary points. Continuing this way, the state space $[\bar{B}, B_{\max}]$ can be divided into a countable number of closed intervals (there is a finite number of possible occupations in each of the countably many future generations), where each interval corresponds to a specific occupational choice of each generation. Let $[B_k, B_{k+1}]$ be such an interval. We now want to establish that the value function is linear over this interval, and that the optimal choice of patience $l(B)$ is single-valued and constant over the interior of this interval.

It is useful to consider the sequential formulation (15) of the decision problem. Taking the present and future occupational choices i_t as given, we can substitute for B_t and write the remaining decision problem over the l_{Bt} on the interval $[B_k, B_{k+1}]$ as:

$$\begin{aligned} v_B(B) = \max \Bigg\{ &\log(w_{1,i_0}) + B \log\left(\frac{w_{2,i_0}}{w_{1,i_0}}\right) - l_0 \\ &+ \sum_{t=1}^{\infty} z^t \left[\log(w_{1,i_t}) + \left(\psi^t \bar{B} + (1-\psi)^t B + \sum_{s=0}^{t} (1-\psi)^{t-s-1} f(l_s) \right) \log\left(\frac{w_{2,i_t}}{w_{1,i_t}}\right) - l_t \right] \Bigg\}. \end{aligned} \quad (17)$$

For given current and future income profiles, (17) is concave in l_t for all t, since f is concave. Moreover, patience B and all expressions involving l_{Bt} appear in separate terms in the sum. If f is strictly concave, it follows that, given the optimal income profiles, for all t the optimal l_t is unique, and independent of B. Since on the interior of $[B_k, B_{k+1}]$ the current and future optimal income profiles are unique, the optimal policy correspondence $l_B(B)$ is single-valued. At the boundary between two intervals there are (by construction of the intervals) at least two different optimal income profiles for at least one generation, hence $l_B(B)$ may take on more than one optimal value, one corresponding to each optimal set of income profiles. If f (or a segment of f) is linear, $l_B(B)$ is still generically single-valued on the interior of each interval, as exact indifference only occurs on a zero-measure subset of the parameter space.

The optimal value function v_B over the interval $[B_k, B_{k+1}]$ is given by (17) with income profiles i_t and investment in patience l_t fixed at their optimal (and constant) values. (17) is linear in B; it therefore follows that the value function is piece-wise linear, with each kink corresponding to the boundary between two of our intervals. Q.E.D.

Proof of Proposition 2: The law of motion for B, $f : [\bar{B}, B_{\max}] \to [\bar{B}, B_{\max}]$, is given by:

$$\Theta(B) = \psi \bar{B} + (1 - \psi)\, B + f\left(l_B\left(B\right)\right),$$

where $l_B\left(B\right)$ is generically a non-decreasing step function (as described in Proposition 1). Since f is an increasing function and we assume that $\psi < 1$, the law of motion $\Theta(B)$ is strictly increasing in B. Notice that $\Theta(B)$ may fail to be single-valued for some B. Strictly increasing here means that $B_h < B_l$ implies $B'_h < B'_l$ for all $B'_h \in \Theta(B_h)$ and $B'_l \in \Theta(B_l)$, even if $\Theta(B_h)$ or $\Theta(B_l)$ is a set. For a given B_0, the law of motion Θ defines (potentially multiple) optimal sequences of patience $\{B_t\}_{t=0}^{\infty}$. Any such sequence is a monotone sequence on the compact set $[\bar{B}, B_{\max}]$, and must therefore converge. Notice, however, that since $l(B)$ is not single-valued everywhere, different steady states can be reached even from the same initial B_0. If f (or a segment of f) is linear, the same results still apply generically, i.e., outside a zero-measure subset of the parameter space. Q.E.D.

Proof of Proposition 3: The strategy of the proof is analogous to the proof of Proposition 1. The Bellman equation (5) defines a mapping T on the space of bounded continuous functions on the interval $[\bar{A}, A_{\max}]$, endowed with the sup norm, where the mapping is given by:

$$Tv_A(A) = \sup_{l_A, n} \left\{ \log(n) + A(1-n) - l_A + z\, v_A(A') \right\}, \tag{18}$$

where $A' = \psi \bar{A} + (1-\psi)A + g(l_A)$. Since we assume $0 < z < 1$, this mapping is a contraction by Blackwell's sufficient conditions, and it therefore has a unique fixed point by the Contraction Mapping Theorem.

To establish that the value function is increasing, let v_A be a non-decreasing bounded continuous function. We need to show that Th is a non-decreasing function. Choose $A_h > A_l$. We want to establish that $Tv_B(A_h) > Tv_B(A_l)$. Since the right-hand side of (18) is the maximization of a continuous function over a compact set, the maximum is attained. Let $\underline{l}$ and $\underline{n}$ be the choices attaining the maximum for A_l. We have:

$$\begin{aligned} Tv_A(A_h) &\geq \log(\underline{n}) + A_h(1-\underline{n}) - \underline{l} + z\, v_A(\psi\bar{A} + (1-\psi)A_h + g(\underline{l})) \\ &\geq \log(\underline{n}) + A_l\ (1-\underline{n}) - \underline{l} + z\, v_A(\psi\bar{A} + (1-\psi)A_l\ + g(\underline{l})) = Tv_A(A_l), \end{aligned}$$

which is the desired result. Here the first inequality follows because the choice $\underline{l}$ may not be maximizing at A_h, and the second inequality follows because $A_h > A_l$ and v_A is assumed to be non-decreasing.

To prove that the value function is (weakly) convex, we establish that the operator T preserves convexity. Let v_A be a convex bounded continuous function. We need to establish that Th is also convex. Choose a number θ such that $0 < \theta < 1$, let $A_h > A_l$, and let $A = \theta A_h + (1-\theta)A_l$. We want to show that $\theta Tv_A(A_h) + (1-\theta)Tv_A(A_l) \geq Tv_A(A)$. Let l and n be choices attaining the maximum for A. Since these are feasible, but not necessarily optimal choices at A_h and A_l, we have:

$$\begin{aligned} Tv_A(A_h) &\geq \log(n) + A_h(1-n) - l + z\, v_A(\psi\bar{A} + (1-\psi)A_h + g(l)), \\ Tv_A(A_l) &\geq \log(n) + A_l(1-n) - l + z\, v_A(\psi\bar{A} + (1-\psi)A_l + g(l)). \end{aligned}$$

Using these inequalities, we have:

$$\begin{aligned} &\theta Tv_A(A_h) + (1-\theta)Tv_A(A_l) \\ &\qquad \geq \theta\left[\log(n) + A_h(1-n) - l + z\, v_A(\psi\bar{A} + (1-\psi)A_h + g(l))\right] \\ &\qquad\quad + (1-\theta)\left[\log(n) + A_l(1-n) - l + z\, v_A(\psi\bar{A} + (1-\psi)A_l + g(l))\right] \\ &\qquad = \log(n) + A(1-n) - l \\ &\qquad\quad + z\left[\theta v_A(\psi\bar{A} + (1-\psi)A_h + g(l)) + (1-\theta)v_A(\psi\bar{A} + (1-\psi)A_l + g(l))\right] \\ &\qquad \geq \log(n) + A(1-n) - l + z\, v_A(\bar{A} + (1-\psi)\left(A - \bar{A}\right) + g(l)) = Tv_A(A), \end{aligned}$$

which is the required condition. The last inequality follows from the assumed convexity of v_A. The operator T therefore preserves convexity, and thus the fixed point must also be convex. Q.E.D.

Proof of Proposition 4: To prove that $l_A(A)$ is a non-decreasing function of A, write the program as:

$$v_A(A) = \sup_{l_A}\left\{-\log(A) + A - 1 - l_A + z\, v_A(\bar{A} + (1-\psi)\left(A - \bar{A}\right) + g(l_A))\right\}.$$

Next, let $l_0 = l_A(A_0)$ and $l_1 = l_A(A_1)$, where $A_1 > A_0$. We want to prove that $l_1 \geq l_0$. To this aim, observe that

$$\begin{aligned} -l_0 + z\, v_A(\bar{A} + (1-\psi)\left(A_0 - \bar{A}\right) + g(l_0)) &\geq -l_0 + z\, v_A(\bar{A} + (1-\psi)\left(A_0 - \bar{A}\right) + g(l_1)) \\ -l_1 + z\, v_A(\bar{A} + (1-\psi)\left(A_1 - \bar{A}\right) + g(l_0)) &\leq -l_1 + z\, v_A(\bar{A} + (1-\psi)\left(A_1 - \bar{A}\right) + g(l_1)) \end{aligned}$$

Subtracting the two equations as before, we get:

$$\begin{aligned} l_1 - l_0 \geq\ & \left(z\, v_A(\bar{A} + (1-\psi)\left(A_0 - \bar{A}\right) + g(l_1)) - z\, v_A(\bar{A} + (1-\psi)\left(A_0 - \bar{A}\right) + g(l_0))\right) \\ & - \left(z\, v_A(\bar{A} + (1-\psi)\left(A_1 - \bar{A}\right) + g(l_1)) - z\, v_A(\bar{A} + (1-\psi)\left(A_1 - \bar{A}\right) + g(l_0))\right) \end{aligned} \tag{19}$$

(19) implies that $l_1 \geq l_0$. To see why, suppose (to derive a contradiction) that $l_1 < l_0$. Then, the left hand-side would be negative, while the right hand-side would be positive, since v_A is increasing and convex. This would contradict the inequality in (19). Therefore, we must have that $l_1 \geq l_0$. Hence, $l_A(A)$ must be non-decreasing in A.

The proof of convergence to the steady state is analogous to the proof of Proposition 2. Consider the equilibrium law of motion $A' = \Gamma(A)$ where

$$\Gamma(A) = \psi \bar{A} + (1-\psi) A + g(l_A(A)).$$

Since g is increasing and l_A is non-decreasing, $\Gamma(A)$ is strictly increasing in A. For a given A_0, the law of motion Γ defines (potentially multiple) optimal sequences of patience $\{A_t\}_{t=0}^{\infty}$. Any such sequence is a monotone sequence on the compact set $[\bar{A}, A_{\max}]$, and must therefore converge. The steady-state expression follows immediately from setting $A = \Gamma(A)$. Q.E.D.

Proof of Proposition 5: The proof is analogous to the proofs of Propositions 3 and 4. The optimal labor supply follows from taking the first-order condition in (8) while respecting the constraints $0 \leq n \leq 1$. Q.E.D.

Sufficient Condition Equilibrium with Constant Wages:

Condition 1 *Assume f to be of the form $f(l_B) = \xi l_B$, where ξ satisfies:*

$$\frac{1-z(1-\psi)}{z} \leq \xi \log(\gamma) \leq \frac{1-z(1-\psi)}{z} \frac{1}{z(1-\psi)}. \tag{20}$$

Proposition 6 *Suppose that Condition 1 is satisfied, and that the economy starts out with everyone having the natural patience $B_0 = \bar{B}$ and the steady-state taste for leisure A. Then for sufficiently large $q > 0$ there exists an equilibrium such that for all $t \geq 2$ the proportion of workers and artisans in the population is constant, and the agricultural wage is given by:*

$$\log w_F = \log\left(\alpha\mu^{\alpha-1}\right) = \log(q) + \bar{B}\log(\gamma) - \frac{\bar{l}_B}{z} + \frac{\xi \bar{l}_B \log(\gamma)}{1-z(1-\psi)}. \tag{21}$$

The equilibrium is characterized by occupational segregation, i.e., from $t \geq 2$ onwards, parents and children in the same dynasty choose the same profession. The taste for leisure remains constant in all dynasties. Worker dynasties do not invest in patience ($l_B = 0$), whereas artisan dynasties invest the maximum amount ($l_B = \bar{l}_B$). The distribution of patience converges to a steady state where the patience of all workers remains at the natural level $\bar{B}$, whereas the patience of all artisans converges to the maximum $B_M = \bar{B} + \xi\bar{l}_B/\psi$.

Proof of Proposition 6: The proposed equilibrium satisfies the following conditions: A positive fraction of the young adults at time $t = 0$ invest in patience (at the level $l_B = \bar{l}_B$) in expectation of their children becoming artisans (at time $t = 2$); the remaining young adults do not invest and set $l_B = 0$; the agricultural wage is constant from time $t = 2$ onwards and adjusts so as to equalize the ex-ante utility of all young adults at time zero; from period $t = 2$ onwards, preferences diverge, and the members of the dynasties that did not invest in the first period prefer to be workers and not to invest in patience, while the members of dynasties that did invest in the first period prefer to be artisans and to invest in patience at the maximum level $l_B = \bar{l}_B$.

We construct the equilibrium in two steps. (i) We derive the equilibrium labor supply μ in agriculture from $t = 2$ onwards (and the corresponding wage) that makes the initial generation just indifferent between investing and not investing, provided that the equilibrium takes the prescribed form. (ii) We show that condition (20) implies that the prescribed occupational choices from period $t = 2$ onwards are indeed optimal.

(i) First notice that since f is linear, conditional on $l_B > 0$ it is (at least weakly) optimal to invest the maximum amount $l_B = \bar{l}_B$. When comparing the utility derived from investing and not investing, we can disregard the utility that the initial generation derives from consumption and leisure because of the separable utility function (this component of utility is the same for all first-generation families). Then, the value of not investing in patience (under the expectation that all future members of the dynasty will choose to be workers) is given by:

$$\tilde{v}_{B,F}\left(\bar{B}\right) = \frac{z}{1-z}\log\left(\alpha\mu^{\alpha-1}\right). \tag{22}$$

This is simply the discounted utility derived from receiving the worker's wage $w_F = \alpha\mu^{\alpha-1}$ from the next generation on. In contrast, the value of investing in patience (under the expectation that all future members of the dynasty will choose to be artisans) is:

$$\tilde{v}_{B,M}\left(\bar{B}\right) = -\bar{l}_B + z\, v_{B,M}\left(\bar{B} + \xi\bar{l}_B\right), \tag{23}$$

where:

$$v_{B,M}\left(B\right) = \log(q) + B\log(\gamma) - \bar{l}_B + z\, v_{B,M}\left(\psi\bar{B} + (1-\psi)B + \xi\bar{l}_B\right).$$

Notice that the artisan's utility depends not just on consumption, but also on the cost of investing $\bar{l}_B$. Solving for $v_{B,M}\left(B\right)$ yields:

$$v_{B,M}\left(B\right) = \frac{\log(q) - \bar{l}_B}{1-z} + \frac{z}{1-z}\frac{\left(\psi\bar{B} + \xi\bar{l}_B\right)\log(\gamma)}{\left(1 - z\left(1-\psi\right)\right)} + \frac{\log\left(\gamma\right)}{1 - z\left(1-\psi\right)}B.$$

Hence,

$$v_{B,M}\left(\bar{B} + \xi\bar{l}_B\right) = \frac{1}{1-z}\left(\log(q) - \bar{l}_B + \frac{\xi\bar{l}_B\log(\gamma)}{1 - z\left(1-\psi\right)} + \log\left(\gamma\right)\bar{B}\right),$$

which can be substituted into (23) to yield:

$$\tilde{v}_{B,M}\left(\bar{B}\right) = -\bar{l}_B + \frac{1}{1-z}\left(\log(q) - \bar{l}_B + \frac{\xi\bar{l}_B\log(\gamma)}{1 - z\left(1-\psi\right)} + \log\left(\gamma\right)B\right).$$

For the first generation to be indifferent between investing and not investing, we must have $\tilde{v_{BA}}\left(\bar{B}\right) = \tilde{v}_{B,M}\left(\bar{B}\right)$, which in turn implies (after standard algebra) condition (21) as stated in the proposition:

$$\log(w_F) = \log\left(\alpha\mu^{\alpha-1}\right) = \log(q) + \bar{B}\log(\gamma) - \frac{\bar{l}_B}{z} + \frac{\xi\bar{l}_B\log(\gamma)}{1 - z\left(1-\psi\right)}.$$

In addition, the corresponding μ has to satisfy $\mu < n$ (where n is equilibrium labor supply), so that there is a positive fraction of artisans. This condition can always be met by choosing q sufficiently large.

(ii) We need to ensure that a young adult in period two who is endowed with patience $\bar{B} + \xi \bar{l}_B$ prefers being an artisan to working in agriculture at the flat wage w_F, while the opposite is true for an adult with patience $\bar{B}$. More formally,

$$\log(q) + \bar{B}\log(\gamma) - \frac{\bar{l}_B}{z} + \frac{\xi \bar{l}_B \log(\gamma)}{1 - z(1-\psi)} \leq \log(q) + \left(\bar{B} + \xi \bar{l}_B\right)\log(\gamma),$$
$$\log(q) + \bar{B}\log(\gamma) - \frac{\bar{l}_B}{z} + \frac{\xi \bar{l}_B \log(\gamma)}{1 - z(1-\psi)} \geq \log(q) + \bar{B}\log(\gamma).$$

These inequalities holds if and only if assumption (20) is satisfied. If these inequalities are satisfied, they hold *a fortiori* for all subsequent generations, because patience increases over time in artisan dynasties. Q.E.D.