The Culture of Entrepreneurship

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Abstract

We study the cultural process through which a society inculcates an entrepreneurial spirit. People work for a guaranteed wage or operate a firm whose return depends on business expertise. The latter is culturally acquired, within the family or outside, and people may choose an occupation different from the one they were socialized into. We show that a cultural bias towards safer occupations from colonial and post-colonial policies leads to stagnation where entrepreneurs do not upgrade technology because of their proficiency with existing methods. An aggregate productivity shock can tip this economy towards growth where cultural inertia gives way to technological progress led by established businesses. A human capital shock where existing business expertise is less useful, in contrast, causes growth through the emergence of a new class of entrepreneurs. In either case culture ceases to be destiny. We relate the theory to historical and recent episodes.

KEYWORDS: entrepreneurship, culture, human capital, colonization, growth
JEL CLASSIFICATION: D10, F54, O30, L26, Z10

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1 Introduction

This paper connects culture to entrepreneurship using a model of intergenerational households. Our primary goal is to understand the economic effects of colonization through a specific cultural channel. Our broader aim is to identify conditions under which culture matters and the same society, freed from cultural moorings, enjoys faster growth.

The incentives for economic development are closely tied to the incentives for industrialization and entrepreneurship. History is replete with instances of small communities – the Huguenots in seventeenth and eighteenth century France, *Parsis* in western India, Chinese traders in south-east Asia – spearheading industry and trade far out of proportion to their numbers (Hagen, 1962, Bisin and Verdier, 2000). The empirical evidence shows a robust positive correlation between family background and occupational choice (for example, Hout and Rosen, 2000, Constant and Zimmermann, 2003). Parental background is known to affect children's risk attitudes (Hyrshko *et al.*, 2011, Klasing, 2012) and evidence from psychology shows that risk-taking differences across cultures are associated with differences in perceived benefits (Weber *et al.*, 2002). There is good reason to believe then that non-economic attributes of societies like cultural values can be consequential for entrepreneurship.

We propose a model of occupational choice where people are either workers or entrepreneurs. The former work for a guaranteed wage, the latter engage in business activities. Individuals are neutral with respect to income risk but their perception of the expected return from a risky technology is molded by cultural transmission. In particular, expected business earnings depend on an understanding of technology, an expertise that can be accumulated over time (Jovanovic and Nyarko, 1996). People differ in skills for and subjective biases (preference) over the two occupations. These are acquired through upbringing, socialization and occupational experience (Bisin and Verdier, 2000). Paternalistic parents prefer their offspring to choose occupations similar to theirs and, accordingly, try to imbue them with occupation-specific human capital. For example, entrepreneurial parents perceive entrepreneurship to be more rewarding and, having acquired expertise in their line of work, attempt to pass on that human capital to their children. Similarly wage-working parents may endow their children with human capital that predisposes them toward wage-work.

Such within-family cultural indoctrination is imperfect. When it fails, the child absorbs the trait of a randomly chosen member of the active population. Either way, children's human capital in the two occupations is determined by the time they become economically active. They then choose whether or not to engage in the occupation they have been indoctrinated in. The interplay of the cultural transmission of human capital and values, the accumulation of business expertise in entrepreneurial lines and the introduction of new technologies generate several possibilities.

A focus on safe production eventually results in stagnation where entrepreneurs do not upgrade technology. In this equilibrium, workers receive wages above what they can expect from entrepreneurship because their business expertise is low, entrepreneurs receive rewards greater than wages. Entrepreneurs do not upgrade technologies because they perceive lower expected returns from doing so given their considerable proficiency – accumulated over generations – with existing methods.[1] Such a persistent, no-growth equilibrium is analogous to some colonial and post-colonial regimes in which wage-work or government employment was highly valued, the pursuit of profits frowned upon and businesses too insular.

This equilibrium is shocked in one of two ways. In the first, the economy experiences an increase in overall productivity, causing existing entrepreneurial lines to start upgrading. The result is top-down growth without socio-economic mobility: existing businesses retain their dominant position, the growth of their business pulling up the rest of the economy. Alternatively, the stagnant equilibrium can be shocked by a sharp, "disruptive", change in the human capital requirement of new technologies. Existing business lines find themselves ill-suited to adopt these new methods since their expertise does not transfer as easily. Some indoctrinated wage workers, on the other hand, become first generation entrepreneurs by adopting new technologies as they are not invested in existing methods of production. Overtaking results, with the entrant lines becoming more productive than incumbents who eventually abandon entrepreneurship to become wage workers. In the long run, the newly emerged class of entrepreneurs keep upgrading their technologies leading to steady-state growth. In the first case, the productivity shock needed to tip the economy towards long-run growth is independent of cultural inertia. In the second case, the human capital shock needed to do so is *inversely* related to cultural inertia. In other words the propensity to benefit from such opportunities is not adversely affected by culture. In both scenarios, those opportunities create a more entrepreneurial spirit over time.

These predictions are linked to the experience of colonial Africa, India, South Korea and Japan. The administration of colonies – in Africa and India – relied on a web of subordinate administrators that propped up the "steel frame" of the colonial administration (Kirk-Greene, 1980). This led to the rise of public education and value systems to train and indoctrinate people into the colonial mission. The salience given to government jobs – in bureaucracy, education and law – created, directly or indirectly, certain role models. When newly independent former colonies turned towards nation-building, this, together with the perceived excesses of western capitalism, translated into an over-reliance on the public sector and a distaste for the uncertainties inherent in the market economy. The example of India is used to illustrate how this lethargy gets overturned from liberalization. The theory is also used to understand the sharp turnaround that Japan and South Korea experienced through forcible economic and cultural changes.

[1] There is no tradeoff between risk and return in our model: entrepreneurs who perceive more uncertain income from a new technology also perceive a lower expected income. It is the latter that risk-neutral individuals base their decisions on. Risk aversion, as long as it did not differ across occupations, would not qualitatively affect the central results since the primary channel by which culture matters is intergenerationally transmitted human capital.

The notion that culture could matter for economic growth is not new. It goes back at least to Weber's (1930) thesis that cultural change, the Calvinist Reformation in particular, was vital to the development of capitalism and its institutions. While some have extended that view to cultural attributes such as openness to new ideas and a scientific temperament (Landes, 1998), others have seen virtue in the West's individualism (Lal, 1999a, and references therein). Despite this abiding historical interest and an emerging one in empirical development economics (for instance Tabellini, 2010, Durante, 2010, Gorodnichenko and Roland, 2013), culture has received little formal treatment in modern growth theory. In large measure this reflects the widespread notion that development is limited only by opportunities and technologies: if incentives are strong enough, culture would change to accommodate economic interests.[2] While our work embraces this conclusion – culture does not limit growth as long as the economy is productive or technological change disruptive enough[3] – we also show that culture matters for the income *level*.

"Culture" has two related interpretations here, one static, the other dynamic. Hofstede (1991, p. 5) defines it as "the collective programming of the mind which distinguishes the members of one group or category of people from those of another". In the model, this has the specific interpretation of a willingness to engage in entrepreneurship depending on one's family background. The willingness evolves through cultural transmission, "transmission from one generation to the next, via teaching and imitation, of knowledge, values, and other factors that influence behavior" (Boyd and Richerson, 1985, p. 2). Besides economic benefits, parents are compelled by culture-specific occupational biases in what skills they transmit to their children. Differently from the Becker approach, the socialization process is not seamless since purposeful parental involvement can fail and create an avenue for social influence.

We build on the literature on cultural transmission, particularly Bisin and Verdier (2000, 2001) and Boyd and Richerson's (1985) pioneering work, and also Hauk and Saez-Marti (2002). In a departure from that literature, human capital, not preference, is transmitted culturally, a fusion of the Bisin and Verdier approach with the Becker model of human capital transmission. We also extend the literature by introducing choice, that is, allowing agents to rationally discard their types should it be in their economic interest. Our assumption of occupation-specific cultural bias is related to Corneo and Jeanne's (2010) work where individuals value the social esteem associated with certain occupations. Here that perception is the product of one's own work experience and society.

[2] Even as Weber saw virtue in the Protestant ethic, he thought Confucian values would hinder East Asia's prospects and the caste system India's (Weber, 1951, 1958). Also influential has been an earlier debate in the profession between those who proposed culture-based non-rationality as an explanation for agricultural backwardness in traditional societies and those who took the "poor but efficient" view of peasant agriculture, a debate that Schultz' *Transforming Traditional Agriculture* (1963) resolved convincingly in favor of the latter (Ruttan, 1988).

[3] The growth rate does not depend on the proportion of the population who are entrepreneurs. It is this that ensures culture does not affect growth as long as the economy enjoys technological progress. It does affect, however, whether or not entrepreneurs upgrade technology. Whether or not culturally transmitted traits affect innovation (as in Klasing, 2012 and Doepke and Zilibotti, 2013, discussed later) or the adoption of technologies (as here) is an open question. On this and evidence of intergenerational transmission see Spolaore and Wacziarg (2013).

The theoretical literature studying the cultural roots of entrepreneurship is relatively new. Kumar and Matsusaka's (2009) work on culturally transmitted local and market capital can be related to entrepreneurship though that is not the authors' focus. In Hassler and Mora (2000), the choice between entrepreneurship and wage work is based on parental knowledge about production and innate intelligence. Using a learning-by-doing technology similar to ours the authors show that larger technological improvements lead to social information being less important, resulting in intergenerational churning: children of workers end up being new entrepreneurs if they have high cognitive ability, children of old entrepreneurs end up being workers if they do not. There is no scope for cultural indoctrination within or outside the family in this. Cultural inertia hence plays no role in technological and economic change.

Two recent papers relate culture to heterogeneous risk preferences in the population. In Doepke and Zilibotti (2013), entrepreneurial work entails upfront human capital investment and risky rewards through the Romer endogenous growth framework. Parents invest in making their children less risk averse or more patient, a within-family cultural transmission that is perfect, immune from social influence. Klasing (2012) too approaches this issue using the Romer framework but her cultural transmission process closely follows Bisin and Verdier (2000) in that children acquire either a high or low (zero) risk aversion from their cultural parent. More risk averse agents always choose to be workers, riskless ones engage in risky innovation. In other words, it is never in an individual's interest to choose an occupation different from that he was prepared for. In neither paper is there a possibility for entrepreneurs to become less suited to entrepreneurship and in both culture always matters for long-run growth.[4]

The main distinguishing features of our paper relative to this literature are technology-specific human capital and the focus: "When does culture cease to matter for growth?" That culture need not be destiny marks a novel contribution of our work to the literature and connects it to specific historical and recent episodes where stagnation, due to cultural inertia from colonization or otherwise, gave way to growth convergence. More generally our paper contributes to the literature on preference-based and evolutionary explanations of long-term change, including Becker and Mulligan (1997), Doepke and Zilibotti (2008), Galor and Moav (2002) and, more recently, Galor and Özak (2014) and Wu (2014).

A benchmark model of occupational choice and cultural transmission is developed in the next

[4]A very different mechanism – Darwinian selection – is at the heart of Galor and Michalopoulos' (2012) theory of entrepreneurship. In their model people are either risk-neutral or risk-averse, the former's economic advantage in early history giving way to the latter's as children get relatively costlier, inducing differential fertility behavior in the two groups. Also relevant here is a complementary and somewhat older literature on (ability, risk preference) heterogeneity, credit frictions and entrepreneurship, surveyed in Parker (2009).

While theories of entrepreneurship often rely on heterogeneous risk preference, there is room to entertain other behavioral explanations. For instance, the psychology literature identifies traits like optimism, over-confidence and motivation among entrepreneurs and, in some studies, entrepreneurs do not seem to be any less risk averse than non-entrepreneurs (Wadeson, 2006).

section under the assumption that entrepreneurs are locked into a particular technology. Technological upgrading is studied in section 3. We show that the constant-technology model is a special case of this general structure and characterize the dynamic equilibria. Section 4 discusses how the model explains entrepreneurship and development in parts of the world. Section 5 concludes.

2 The Baseline Model

Childhood and adulthood are the two stages of life in an overlapping generations economy. In any period $t = 1, 2, \ldots, \infty$ a set $\mathscr{H}$ of agents of measure one are economically active in either of two occupations, wage-work and entrepreneurship. Each agent is endowed with a unit time and gives birth to one offspring during this period, dying at the end. An offspring born in t does not become economically active until $t+1$.

2.1 Occupation and Production

Entrepreneurs engage in production through imperfectly understood technologies while wage-work entails a steady income, for instance, supplying labor on a competitive market in the public sector.[5] People differ in how they subjectively value the two occupations and in their human capital. We treat this human capital as one dimensional – business expertise – that in the model takes the form of subjective beliefs about the riskiness of production technologies.

At the beginning of each period, an active agent must decide whether to become an entrepreneur or work for entrepreneurs at the market wage. Human capital in entrepreneurship and the broader macroeconomic environment determine this choice.[6] Public sector employment is incorporated later. We assume no unemployment or withdrawal from the labor force. Individuals care about their expected income y which is either profit income π or wage income w. In other words, individuals indivisibly supply their labor to wage-work or in managing their business. The latter is preferred as long as it yields a higher expected income.

Let $\mathscr{E}_t$ denote the subset of agents who become entrepreneurs at t and $\mathscr{H} \backslash \mathscr{E}_t$ the subset of individuals who work for a wage. Product and input markets are perfectly competitive. All workers

[5] The alternative occupation can also be low-scale self-employment with lower returns. In other words, here entrepreneurship is not synonymous with self-employment. Rather, an entrepreneur is someone willing to embrace big change and innovate. This distinction is important to keep in mind as a lot of empirical work proxies entrepreneurship with self-employment which is widespread in developing countries, in many cases exceeding rates in industrialized countries. For this and related concerns with using self-employment data see Parker (2009, Ch. 1).

[6] Implicitly the labor productivity of all individuals is being normalized to unity. It is easy to introduce heterogenous human capital specific to wage work and allow wage-working parents to transfer their skills to their offspring and build on them. As long as there is no market imperfection preventing the efficient level of such within-family investment and human capital accumulation is subject to diminishing returns, all wage-working families will eventually converge to the same skill level. What matters in that setup, as here, is an individual's comparative advantage in the two occupations. Hence cultural and occupational decisions would be analogous to those we analyze below.

are hired by entrepreneurs at the market wage rate w_t and all entrepreneurs produce the same homogeneous good $\{Y_k\}_{k\in\mathscr{E}}$ using a CRS technology.[7] Aggregate output is simply

$$Y_t = \sum_{k\in\mathscr{E}_t} Y_t^k.$$

The price of each good is normalized to one. Entrepreneur (capitalist) k uses two inputs, labor L_t^k hired in the competitive market and his own input that we call business capital z_t^k:

$$Y_t^k = \left(z_t^k\right)^{1-\beta}\left(L_t^k\right)^{\beta},\ \beta\in(0,1). \tag{1}$$

Business capital is *ex ante* uncertain. It depends on the technology used for production, the entrepreneur's understanding of it and entrepreneurial decision ϕ taken before the business goes into production by hiring workers. The capital thus produced is an inalienable part of entrepreneur k's business venture and is not transferable to other businesses. We solve for entrepreneur k's decision problem backwards. Given z_t^k, profit maximization leads to the labor demand

$$\beta\left(\frac{z_t^k}{L_t^k}\right)^{1-\beta} = w_t \tag{2}$$

with more productive entrepreneurs – those with higher business capital – hiring more. Using this in equation (1), the entrepreneur's expected profit at the beginning of t becomes

$$\pi_t^k = (1-\beta)\left(\frac{\beta}{w_t}\right)^{\beta/(1-\beta)} z_t^k \equiv \kappa_t z_t^k \tag{3}$$

which is increasing in business capital z_t^k chosen prior to going into production.

Denote the technology at the entrepreneur's disposal by some arbitrary n. Entrepreneur k takes a decision ϕ_t^k that determines his business capital according to a stochastic production function similar to Jovanovic and Nyarko (1996):

$$\tilde{z}_{nt}^k = a^n\left[1-\left(q_{nt}-\phi_{nt}^k\right)^2\right],\ a>1. \tag{4}$$

Here

$$q_{nt} = \theta_n + \nu_{nt} \tag{5}$$

is a random target that fluctuates around a technology-specific parameter θ_n and ν_{nt} is an *iid* shock drawn from a normal distribution with mean zero and variance σ_ν^2. The same technology is used by all entrepreneurs and for all $t\geq 1$. Later we allow them to choose from several grades of

[7] While k represents a particular entrepreneur, we later use b to tag variables for the entire set $\mathscr{E}_t$.

technology, indexed by $n \in [0,\infty)$, with a higher n corresponding to a (potentially) higher return technology.

The entrepreneur knows a and the distribution of ν_{nt}. What he does not know is the mean target output θ_n about which he has some belief (prior). One way to interpret ϕ is as effort devoted towards fine-tuning some machinery that yields a stochastic output, based partly on how effectively it is employed in production. Alternatively and closer to the spirit of the model, think of the entrepreneur as entering a market or innovating a product for which he needs to determine the optimal scale of operation q_{nt} without having full information about market conditions. The quadratic loss function embedded in (4) says that he can lose out from both over- and under-supply of business capital, a reduced-form specification of having to sell below cost in case he overestimates market demand or forgoing profit opportunities from underproduction.

Denote by $E_t^k(\theta_n)$ the conditional expectation and $x_{nt}^k \equiv V_t^k(\theta_n)$ the conditional variance for entrepreneur k. The cumulative distribution of priors over q_{nt} for the n-th grade technology in the population at t is denoted by $G_t(x_{nt})$. The population is endowed with $G_1(x_{n1})$ in the initial period; subsequently G_t is the outcome of cultural indoctrination and occupational choice.

Business capital is higher the closer is the entrepreneur's decision ϕ_{nt}^k to the target output level q_{nt}. From (3), (4) and (5), it follows that the optimal decision that maximizes expected business capital is

$$\phi_{nt}^k = E_t^k(\theta_n). \tag{6}$$

This yields expected business capital

$$z_{nt}^k \equiv E_t\left(\tilde{z}_{nt}^k\right) = a^n\left[1-\sigma_\nu^2 - x_{nt}^k\right]. \tag{7}$$

Equation (7) shows that the entrepreneur's belief about θ_n is a form of human capital or expertise. Agents with more informed beliefs – smaller x_{nt}^k – expect to earn a higher return from entrepreneurship. In observing q_{nt} during his lifetime running the business, the agent learns about the technology and updates his belief about θ_n. That is, he acquires additional expertise through learning-by-doing. He may then choose to impart this knowledge to his cultural offspring who, in turn, will be able to make a more informed decision $\phi_{n,t+1}^k$ should he become an entrepreneur. This means if entrepreneurial human capital is transmitted via cultural transmission and socialization, business expertise specific to an entrepreneurial line does not disappear.[8] We show later that the learning process is bounded for a given technology: sticking with a grade n along an entrepreneurial line allows agents to eventually learn θ_n completely. Consequently, expected busi-

[8]There is no mean reversion in intergenerational ability unlike Caselli and Gennaioli's (2013) model of dynastic firms. Of course, neither do we have dynastic firms. As will be clear shortly, what we call an entrepreneurial line is a series of entrepreneurs – some biologically related, some culturally – who are linked through their human capital.

ness capital converges to $a^n(1-\sigma_\nu^2)$ in the limit, with expected business profit converging to

$$\pi_t^k = \kappa_t a^n \left[1-\sigma_\nu^2\right], \tag{8}$$

identical for all entrepreneurs since it is independent of initial beliefs.[9]

2.2 Preferences

Children are not born with innate skills in the two occupations or pre-determined preferences about them. These develop through cultural transmission at home (vertical transmission), socialization outside (oblique transmission) and work experience. Parents are paternalistic in that they believe they know better which occupation would better suit their children (Bisin and Verdier, 2000). Their altruism payoff V depends on their children's future well-being which they evaluate through their own experience. Moreover, over their working lives parents acquire a subjective bias towards their own occupation and they dislike the prospect of their children going into an occupation different from theirs. In imparting human capital suitable to his occupation, a parent weighs the potential utility of his offspring by using his payoff matrix as if it were the child's.

Not all such vertical transmission is successful since children also socialize and absorb ideas outside of home. Higher parental effort $\tau \in (0,1)$ towards cultural education raises the likelihood of the offspring being similar to the parent. But due to socialization outside, such education may fail and the offspring picks up human capital from a randomly matched (cultural) parent who may well be in an occupation different from his biological parent's. We shall refer to this process of vertical and oblique transmission as *cultural indoctrination.*

The expected lifetime utility of an economically active individual at time t

$$U_t = y_t + V_t - \psi(\tau_t)$$

depends on his expected lifetime income, $y_t \in \{w_t, \pi_t\}$, the perceived welfare of his offspring, V_t, and socialization cost $\psi(\tau_t)$.

2.3 Socialization and Cultural Transmission

Even though socialization, whether through vertical or oblique transmission, imparts to the cultural offspring parental human capital in the two occupations, the offspring may choose not to follow his cultural parent's occupation. To allow for this we denote the culturally indoctrinated fraction of wage workers in the population by m and their actual frequency by μ. We introduce two

[9]Even if an entrepreneur were to learn θ_n precisely, he would still face (price, demand) uncertainty inherent in any business venture through ν_{nt}.

definitions.

Definition 1. *Cultural indoctrination is **persistent** if a cultural offspring does not choose an occupation different from that in which he has been indoctrinated.*

Definition 2. *Cultural indoctrination is **dynamically persistent** if it is persistent for all agents and all $t \geq 1$.*

In the remainder of this section we focus on an intertemporal equilibrium path that is dynamically persistent, that is, $m_t = \mu_t$ for all $t \geq 1$. Hence the dynamics of m is the same as that of μ.

A parent educates his naive biological child with the socialization effort τ. With probability equal to this effort, vertical transmission is successful and the child acquires the biological parent's type, here human capital (Hauk and Saez-Marti, 2002). That is, the child of an entrepreneurial parent picks up the parent's posterior belief about technologies as his own prior and a child of a wage-working parent likewise acquires his parent's uninformed belief regarding how to operate businesses. If vertical transmission fails, the child remains naive and gets randomly matched with somebody else whose occupation-specific human capital he acquires. Recall that business capital is stochastic and an inalienable part of an entrepreneur's venture. Though it is not possible to acquire business expertise simply by observing one entrepreneur's success (which could be due to luck), we assume that naive children may be able to acquire it from repeatedly observing enough such successes, a proxy for which is the frequency of entrepreneurs in the population $1 - \mu$. This makes business expertise partially excludable.

Let $p_t^{\jmath \ell}$ denote the probability that a child of a type $\jmath$ parent will be of type ℓ where $\jmath, \ell \in \{k, w\}$, k denoting an entrepreneurial and w a wage-working individual. We have

$$p_t^{ww} = \tau_t^w + \left(1 - \tau_t^w\right) \mu_t \tag{9}$$

$$p_t^{wk} = \left(1 - \tau_t^w\right)(1 - \mu_t) \tag{10}$$

where μ_t is the proportion of pro-wage agents at date t. Similarly, for an entrepreneurial parent we have

$$p_t^{kk} = \tau_t^k + \left(1 - \tau_t^k\right)(1 - \mu_t) \tag{11}$$

$$p_t^{kw} = \left(1 - \tau_t^k\right) \mu_t \tag{12}$$

where τ^k is the entrepreneurial parent's effort on social education.

The cost of socialization effort $\psi(\tau)$ satisfies $\psi' > 0$, $\psi'' > 0$, $\psi(0) = \psi'(0) = 0$ and $\psi \in [0,1]$. Let $V^{\jmath \ell}$ denote the utility a type $\jmath$ parent derives from his child being type ℓ. Parental altruism is paternalistic in the sense that the parent uses his own payoff matrix to evaluate this utility. Hence given the parent's expected returns y_t, each parent of type $\jmath \in \{w, k\}$ chooses the social education effort τ to maximize

$$p_t^{\jmath\jmath} V^{\jmath\jmath}\left(y_t^{\jmath}\right) + p_t^{\jmath\ell} V^{\jmath\ell}\left(y_t^{\jmath}\right) - \psi\left(\tau_t\right). \tag{13}$$

Substituting (9)–(12) into the first order condition for an interior optimum

$$\frac{\partial \psi\left(\tau_t\right)}{\partial \tau_t} = \frac{d p_t^{\jmath\jmath}}{d\tau_t} V^{\jmath\jmath}\left(y_t^{\jmath}\right) + \frac{d p_t^{\jmath\ell}}{d\tau_t} V^{\jmath\ell}\left(y_t^{\jmath}\right)$$

leads to

$$\frac{\partial \psi\left(\tau_t^w\right)}{\partial \tau_t^w} = \left[V^{ww}\left(y_t^w\right) - V^{wk}\left(y_t^w\right)\right](1-\mu_t), \tag{14}$$

$$\frac{\partial \psi\left(\tau_t^k\right)}{\partial \tau_t^k} = \left[V^{kk}\left(y_t^k\right) - V^{kw}\left(y_t^k\right)\right]\mu_t. \tag{15}$$

It follows that the optimal socialization effort is

$$\tau_t^{\jmath} = \tau\left[\mu_t, V^{\jmath\jmath}\left(y_t^{\jmath}\right) - V_t^{\jmath\ell}\left(y_t^{\jmath}\right)\right], \ \jmath, \ell \in \{k, w\} \tag{16}$$

with $\partial\tau^w/\partial\mu < 0$ and $\partial\tau^k/\partial\mu > 0$. Parents have less incentive to educate their children the more frequent is their type in the population.

It remains to specify how parental utility depends on the offspring's occupation. As mentioned above paternalistic parents base this on their own payoffs. An entrepreneurial parent's human capital is his belief x_{nt}^k about the distribution of θ_n. Conversely, a wage-working parent lacks human capital specific to entrepreneurial activities which results in a more dispersed prior of $\overline{x}_n$ (see below). Based on these, we specify parental utilities as[10]

$$\begin{aligned}
V_t^{ww} &= \ln w_t, \\
V_t^{wk} &= \ln\left(\pi_t^k(\overline{x}_n)\right) - \ln\delta_w = \ln\left[\kappa_t a^n(1-\sigma_v^2 - \overline{x}_n)\right] - \ln\delta_w, \\
V_t^{kk} &= \ln\left(\pi_t^k(x_{nt})\right) = \ln\left[\kappa_t a^n(1-\sigma_v^2 - x_{nt})\right], \\
V_t^{kw} &= \ln w_t - \ln\delta_b.
\end{aligned} \tag{17}$$

The parameters δ_b (same for all k) and δ_w denote the subjective dissatisfaction that a type $\jmath$ parent feels when his child ends up in type ℓ occupation. These biases do not affect a parent's choice of or utility from his own occupation, only his cultural indoctrination effort. A focus on safer occupations, for instance because of well paying public sector jobs or the experience of colonial expropriation or even exposure to external risks that tend to disproportionately affect agricultural and natural resource production, may be viewed as giving rise to high δ_w and low δ_b over time such

[10]The curvature is to ensure the existence of a balanced growth path when we later allow technology to be upgraded.

that $\delta_w > \delta_b$. Conversely it is possible that societies where settled agriculture was less productive in the past see a stronger tendency towards taking risks and evolve towards a high value of δ_b. We expect $\delta_w > \delta_b$ to be a more natural description of many developing countries, particularly those that were colonies and pursued socialist policies subsequently. We later show that cultural change is possible from market forces even though these parameters do not change.

It is useful to think of $(x_n^J, \delta_b, \delta_w)$ as the "cultural endowments" of this economy (Hayami and Ruttan, 1985). These embody those aspects of preferences and skills that have an impact on the cultural transmission of attitudes. Importantly, cultural endowments have an economic significance here since they shape individuals' perception of the return from each type of activity (Weber *et al.*, 2002).

Example 1. *Suppose $\psi(\tau) = \tau^2/2 \in (0, 1/2)$. Then optimal socialization efforts are*

$$\tau_t^w = (1-\mu_t)\ln\left[\frac{\delta_w w_t^{1/(1-\beta)}}{(1-\beta)\beta^{\beta/(1-\beta)} a^n (1-\sigma_v^2 - \overline{x}_n)}\right],$$
$$\tau_t^k = \mu_t \ln\left[\frac{\delta_b (1-\beta)\beta^{\beta/(1-\beta)} a^n (1-\sigma_v^2 - x_{nt}^k)}{w_t^{1/(1-\beta)}}\right],$$

increasing in own occupational bias and payoff, decreasing in the frequency of and payoff from the alternative occupation. Occupational biases are absent if $\delta_b = \delta_w = 1$. If, in addition, occupational incomes were equalized, for example if business knowledge were alienable and easily acquired, neither wage-working nor entrepreneurial parents would indoctrinate their offspring, $\tau^w = \tau^k = 0$.

2.4 Occupational Income and Choice

An entrepreneur k who works with the technology n at t, starts with a belief about the distribution of θ_n which is, as specified above, normal with variance x_{nt}^k. During the course of his lifetime, the accumulated experience of observing q_{nt} leads him to update this belief. His posterior variance of θ_n becomes, as a result of Bayesian updating,

$$x_{nt+1}^k = \mathscr{F}(x_{nt}^k) = \frac{\sigma_v^2 x_{nt}^k}{\sigma_v^2 + x_{nt}^k}. \tag{18}$$

This posterior belief is then transferred, through imperfect cultural indoctrination, as the offspring's prior. Since $\mathscr{F}$ is increasing and concave with $\mathscr{F}(0) = 0 = \mathscr{F}'(0)$, it has a unique fixed point at $x_n^* = 0$. Hence the learning process along an entrepreneurial line – each generation of entrepreneur passing on his accumulated human capital – generates a sequence of variances $\{x_{nt}^k\}_{t=1}^{\infty}$ that converges monotonically to zero. In this sense, the entrepreneurial line eventually achieves full proficiency and maximal expected earnings if it were to stay with technology n forever.

From each entrepreneur's labor demand

$$w_t = \beta \left[\frac{z_{nt}^k}{L_{nt}^k} \right]^{1-\beta}$$

it follows that aggregate labor demand is $L_{nt}^D = \sum_k L_{nt}^k = \beta^{1/(1-\beta)} Z_{nt} / w_t^{1/(1-\beta)}$ where $Z_{nt} \equiv \sum_k z_{nt}^k$ is aggregate business capital. Since each worker supplies a unit time, aggregate labor supply is $L_t^S = \mu_t$, using which we get the market-clearing wage rate

$$w_t = \beta \left[\frac{Z_{nt}}{\mu_t} \right]^{1-\beta}. \tag{19}$$

The equilibrium wage is decreasing in μ_t because a higher μ lowers the supply of business capital and raises the supply of labor. As a result, expected business profit π_n – see (3) – is increasing in μ. In other words, the culturally indoctrinated share of the population determines the relative attractiveness of the two occupations and, thus, occupational choice. This interdependence reflects the persistence of the culture of *fonctionariat* (civil servants) and underdevelopment in many Africa countries and in India until recently.

To study occupational allocation and the dynamics of cultural indoctrination we proceed in steps. First we restrict the parameter space, anticipating that the dynamics exhibits monotonic convergence, such that indoctrination is dynamically persistent and offspring choose the occupation their cultural parent intended. We then establish that under that restriction, the dynamics is in fact characterized by monotonic convergence to a steady state with an inefficiently low supply of entrepreneurs.

Begin by considering an individual at t who comes from the entrepreneurial line k, having acquired his cultural/biological parent k's human capital at $t-1$. Given this human capital x_{nt}^k he will choose entrepreneurship as long as expected business profit exceeds the wage rate

$$\pi_{nt}^k > w_t \Rightarrow (1-\beta)\beta^{\beta/(1-\beta)} z_{nt}^k > w_t^{1/(1-\beta)}. \tag{20}$$

We study conditions under which this is true for all entrepreneurial offspring, that is, we solve for an equilibrium where no offspring indoctrinated into entrepreneurial activity abandons his cultural parent's occupation, choosing to become a wage worker instead. Using (19) in (20), this requires

$$\frac{z_{nt}^k}{Z_{nt}} > \frac{\beta}{1-\beta} \frac{1}{\mu_t} \quad \forall k \in \mathcal{E}_t. \tag{21}$$

To identify an equilibrium path along which indoctrination is persistent, we start with the plausible scenario that there is an initial scarcity of entrepreneurs, that is,

$$\mu_1 > \mu^* \tag{22}$$

where μ^* is the steady-state share of wage-workers in the population (to be established). We anticipate that along the equilibrium path the economy monotonically converges to μ^* from above.

Assume that the initial distribution of priors is discrete. Specifically it takes two values $x_{n1} \in \{\underline{x}_n, \overline{x}_n\}$ with $\overline{x}_n > \underline{x}_n$ and $\Pr\{x_{n1} = \underline{x}_n\} \equiv G_1(\underline{x}_n)$ and $\Pr\{x_{n1} = \overline{x}_n\} \equiv 1 - G_1(\underline{x}_n)$ fractions of the population with these priors respectively. When agents with the more diffuse prior $\overline{x}_n$ become wage workers and those with the less diffuse prior $\underline{x}_n$ entrepreneurs in $t = 1$, we have $m_1 = \mu_1 = 1 - G_1(\underline{x}_n)$. For this, none of the potential workers should unilaterally want to become an entrepreneur, that is, $w_1 > \pi(\overline{x}_n)$. Using (3) and (19) this becomes

$$\frac{z(\overline{x}_n)}{z(\underline{x}_n)} \frac{1 - G_1(\underline{x}_n)}{G_1(\underline{x}_n)} < \frac{\beta}{1-\beta}. \tag{23}$$

A similar restriction for the entrepreneurs, inequality (21), requires that

$$\mu_1 = 1 - G_1(\underline{x}_n) > \beta.$$

Combining the two inequalities we get a restriction on the initial distribution

$$\beta < 1 - G_1(\underline{x}_n) < \beta \left[\frac{1}{\beta + (1-\beta)\lambda_n} \right] \tag{A1}$$

where $\lambda_n \equiv (1 - \sigma_v^2 - \overline{x}_n)/(1 - \sigma_v^2 - \underline{x}_n) < 1$. We assume henceforth that (A1) holds. It ensures that, given G_1, the initial share of wage workers exceeds the efficient allocation but the share is not so high that it depresses wages below expected business income even at the uninformed prior of $\overline{x}_n$. The latter requires that λ_n be small enough, that is, agents indoctrinated in entrepreneurship acquire a sufficiently strong comparative advantage in it.

Finally we need to ensure that cultural indoctrination is dynamically persistent for all t for which (A1) is not sufficient. Since entrepreneurs are identical in their business expertise and learn at the same rate, $z_{nt}^k / Z_{nt} = 1/(1 - \mu_t)$. Hence (21) simplifies to $\mu_t > \beta$ for which it is sufficient that

$$\mu^* > \beta \tag{A2}$$

if μ_t converges to μ^* from above as we have conjectured. Using an example later we illustrate what parametric restrictions ensure (A2). Note that in steady state each entrepreneur's expected business capital has asymptotically converged to the same level $a^n \left[1 - \sigma_v^2\right]$ while aggregate business capital has converged to $(1 - \mu^*) a^n \left[1 - \sigma_v^2\right]$ by the law of large numbers.

To summarize this discussion, Figure 1 illustrates occupational allocation at t using the relationship between expected business income and the wage rate in (20) above: entrepreneurial expected income is monotonically falling in how diffuse the prior x is. Since cultural indoctrination is persistent, the wage working prior stays stuck at $\overline{x}_n$ while the entrepreneurial prior converges asymptotically to zero. In other words, the distribution of priors in the population remains discrete at all points in time. As depicted in Fig 1, $\underline{x}_{nt}$ is the prior of all culturally indoctrinated entrepreneurs at t, less than their initial prior $\underline{x}_n$ due to learning-by-doing. For priors lower than $\hat{x}_{nt}$, entrepreneurs have sufficiently high expertise that they can expect a higher income than wage work. If the prior exceeds $\hat{x}_{nt}$, on the other hand, wage work dominates. This leads to the following Proposition.

Proposition 1. *Under* (A1) *and* (A2), *at any* t, *agents with a prior lower than some* $\hat{x}_{nt} \in (0, \overline{x}_n)$ *become an entrepreneur and choose the socialization effort* τ_t^k *given by* (16) *for* $\jmath = k$. *Conversely, any agent with prior higher than* $\hat{x}_{nt}$ *will choose to become a wage worker and the socialization effort* τ_t^w *given by* (16) *for* $\jmath = w$.

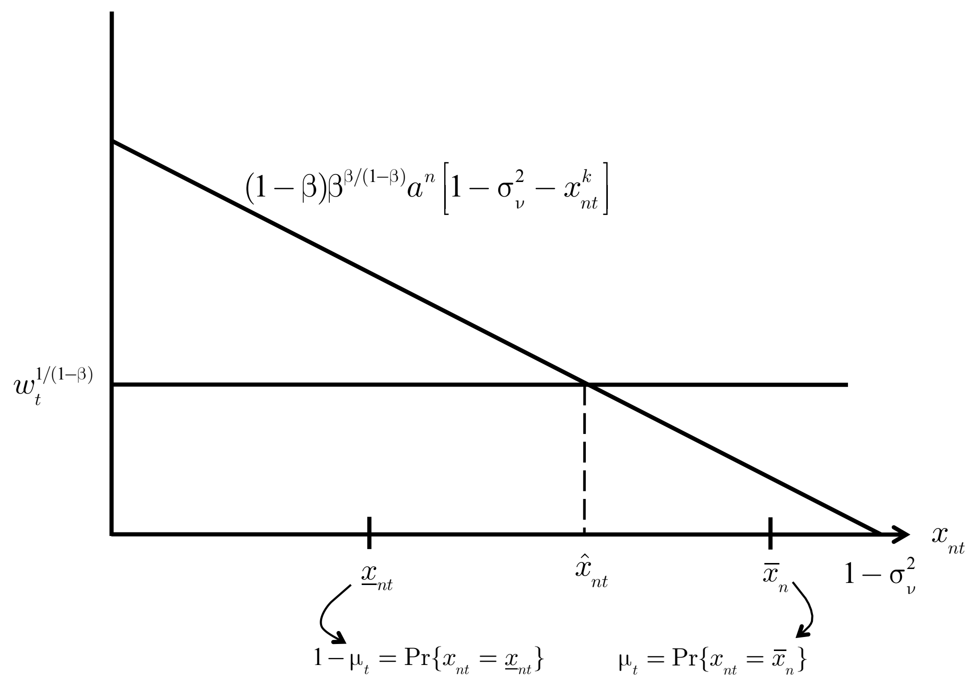


Figure 1: Occupational Allocation at t

2.5 Dynamics

We now characterize the dynamic behavior of $\mu_t \equiv 1 - G_t(\underline{x}_n)$. The pool of wage workers in the $t+1$-th generation is comprised of three groups. First are the children of wage working parents from the t-th generation for whom the social education effort was successful,

$$\tau_t^w \Pr\{x_{nt} = \overline{x}_n\} = \tau_t^w \mu_t$$

The second group consists of those offspring for whom the socialization effort was unsuccessful but who were subsequently matched with a wage working cultural parent. The proportion of these agents is

$$\mu_t(1-\tau_t^w)\Pr\{x_{nt} = \overline{x}_n\} = (1-\tau_t^w)\mu_t^2.$$

Future wage-workers are also drawn from the children of entrepreneurial parents for whom the socialization effort was unsuccessful and who were subsequently matched with a wage working cultural parent:

$$\mu_t(1-\bar{\tau}_t^b)\Pr\{x_{nt} = \underline{x}_{nt}\} = (1-\bar{\tau}_t^b)\mu_t(1-\mu_t)$$

where

$$\bar{\tau}_t^b \equiv \frac{\tau_t^k \Pr\{x_{nt} = \underline{x}_n\}}{1-\mu_t} = \tau_t^k$$

is the average socialization effort among entrepreneurial families, same for all k under the assumption that x_{n0} takes only two values.

The evolution of μ is then governed by

$$\mu_{t+1} = \tau_t^w \mu_t + (1-\tau_t^w)\mu_t^2 + (1-\bar{\tau}_t^b)\mu_t(1-\mu_t)$$

or,

$$\Delta\mu_t \equiv \mu_{t+1} - \mu_t = \left(\tau_t^w - \bar{\tau}_t^b\right)\mu_t\left(1-\mu_t\right) \tag{24}$$

where the educational efforts depend on occupation- and belief-specific payoffs and μ from equations (16) and (17) above. In steady state, $V_t^{ww} - V_t^{wk} = V^{ww} - V^{wk}$ and $V_t^{kk} - V_t^{kw} = V^{kk} - V^{kw}$ for all t. Equation (24) has three steady states, zero, one and μ^* given by

$$\mu^* = \frac{V^{ww} - V^{wk}}{(V^{kk} - V^{kw}) + (V^{ww} - V^{wk})} \tag{25}$$

where both types of parents make the same socialization investment

$$\tau^w\left(\mu^*, V^{ww} - V^{wk}\right) = \tau^k\left(\mu^*, V^{kk} - V^{kw}\right).$$

The following proposition establishes the stability of this steady state and Figure 2 provides an intuitive justification (see Bisin and Verdier, 2000, for details). Above μ^*, wage workers expend less socialization effort than entrepreneurs. This is because the wage rate is lower relative to entrepreneurial returns (at either prior) and wage workers are, in any case, widely represented in the population. The reverse is true below the steady state.

Proposition 2. *Under A1 and A2, μ_t monotonically converges to μ^* from above.*

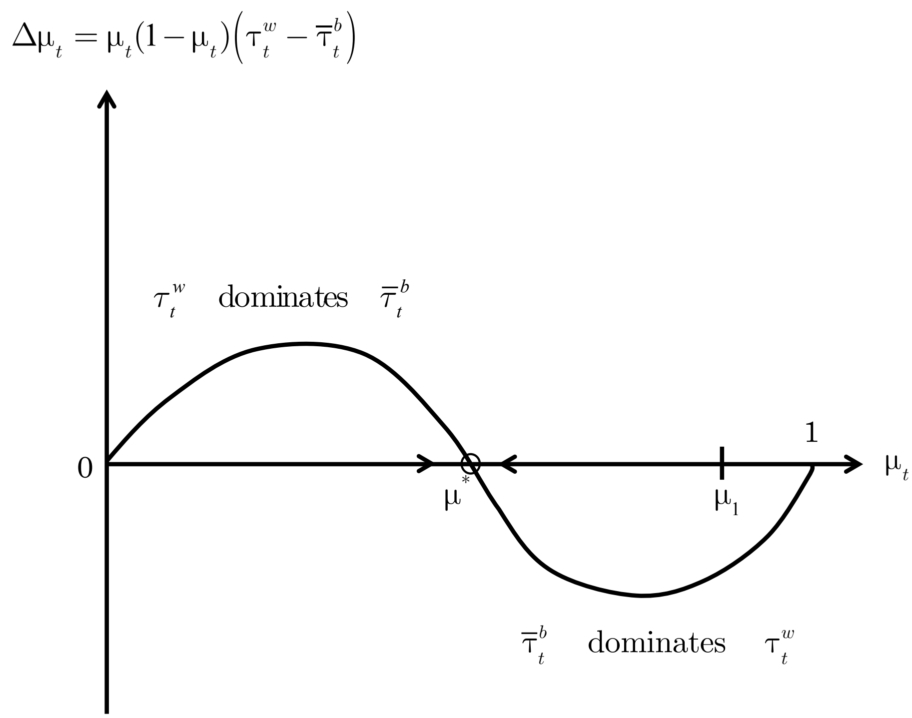


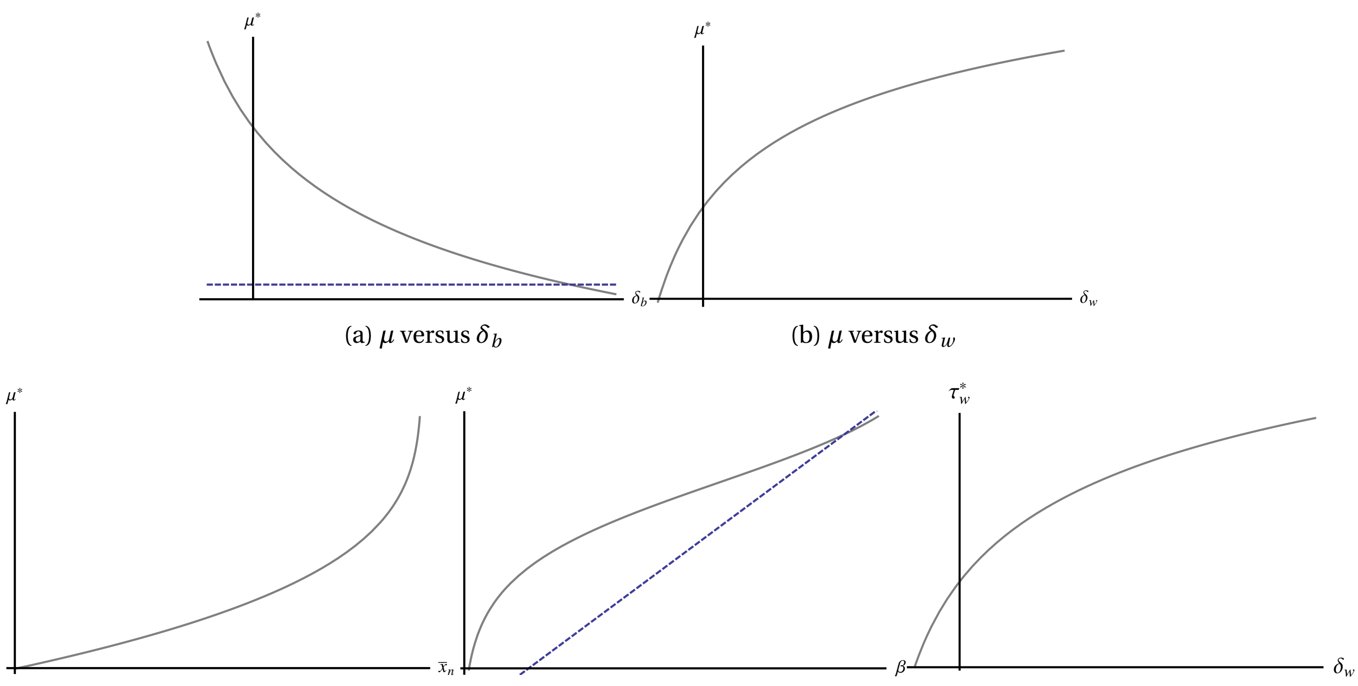
Figure 2: Dynamics of Occupational Type

Aggregate output, given the technology n, is maximized when $\mu_t = \beta$ and entrepreneurs and workers earn the same expected income. This efficient outcome does not occur here even in steady state except when subjective occupational biases are absent and incomes are equalized. Typically we would expect $\mu^* > \beta$, that is, an undersupply of entrepreneurship and depressed aggregate output for three reasons. In the first place, entrepreneurship requires business-specific expertise that is private knowledge. This restricts entry into entrepreneurship. On top of this are two distortions related to the cultural process. Parents prefer their children to be like them (occupationally) and impart those values through successful socialization. These take the form of business expertise and occupation-specific biases. Moreover, parental indoctrination is not always successful. Even if almost all parents were to be entrepreneurial, not all their biological offspring would be. If wage-working parents have a stronger bias ($\delta_w > \delta_b$) and are relatively uninformed about running a business ($\overline{x}_n >> \underline{x}_n$), their indoctrination effort will strongly dominate those of entrepreneurial families. This would intensify the first distortion, restricting even more the supply of entrepreneurship. The following example highlights these margins.

Example 2. *Under the functional form for $\psi(\tau)$ and socialization efforts from Example 1, and the* *equilibrium wage from* (19)*, the steady-state supply of wage-workers μ^* implicitly solves:*

$$\ln\left(\frac{1-\mu^*}{\mu^*}\right) = \ln\left(\frac{1-\beta}{\beta}\right) + \mu^* \ln \delta_b - \left(1-\mu^*\right) \ln \left[\delta_w \left(\frac{1-\sigma_v^2}{1-\sigma_v^2-\overline{x}_n}\right)\right].$$

*Fig 3 shows that this is decreasing in entrepreneurial bias (δ_b), increasing in wage worker bias (δ_w), and increasing in how uninformed wage workers are about business ($\overline{x}_n$). The dotted line shows the efficient outcome β, μ^* always exceeding it in the second and third panels. Note that, for a given vector $(\delta_b, \delta_w, \beta)$, $\mu^* > \beta$ as long as $\overline{x}_n$ is high enough. If occupational biases were absent, that is $\delta_b = \delta_w = 1$, and business expertise were alienable, the efficient outcome $\mu^* = \beta$ is obtained. Finally, the last panel shows socialization effort of wage working parents (same as that of entrepreneurial parents in steady state) is increasing in their occupational bias. This means higher biases increase intergenerational transmission intensity and, thereby, **cultural inertia** as measured by how far μ^* lies above β.*



(a) μ versus δ_b

(b) μ versus δ_w

(c) μ versus $\overline{x}_n$

(d) μ versus β

(e) τ_w versus δ_w

Figure 3: Steady-state Entrepreneurship and Socialization
$\beta = 0.6, \delta_w = 6, \delta_b = 2, \sigma_v^2 = 0.1, \overline{x}_n = 0.7$

The steady state is inefficient, with too few entrepreneurs, as long as $\delta_w \geq \delta_b$. That the allocation is inefficient even with $\delta_w = \delta_b = 1$ is partly due to culture. Suppose, for example, that the frequency of each type in the population depended on Darwinian replicator dynamics: more become entrepreneurial type instead of wage-worker type as long as the expected return from entrepreneurship is higher. In steady state, with no net inflow into wage-work or entrepreneurship, the returns from the two occupations have to equalize. That is, the efficient outcome would be obtained. This is mechanical of course, but shows that inefficiency occurs due to purposeful within-family indoctrination – the cultural transmission of human capital – besides the inalienability of business capital. The possibility that within-family transmission can fail tends to attenuate this when $\bar{\tau}^b > \tau^w$: in fact for a sufficiently high δ_b in Fig 3(a), the supply of entrepreneurship can be inefficiently high. Conversely, $\delta_w > \delta_b$ intensifies the preference towards the safer occupation.[11]

2.6 Government Employment

The resistance to productivity-enhancing technological change in developing countries often stemmed from colonial-era bureaucracies and education policies geared towards training the local workforce in the colonial mission. Public-sector employment was subsequently broadened, further luring people away from entrepreneurship. The model can be readily modified to include this.

Suppose that the government hires $1-f$ fraction of the workforce (e.g. an employment guarantee scheme) every period to provide a public good g that is perfectly substitutable with private consumption. Moreover the public good is linearly produced using labor alone. If the government has no wage-setting power, it would hire these workers at the market wage w_t paid out of lump-sum taxes on labor and business income. This modifies the labor supply in the private sector to $f\mu_t$, wage-workers being indifferent between working for firms versus the public sector. It is easy to anticipate that public sector employment would intensify the cultural bias against entrepreneurship as the competition for workers drives up the wage rate and down expected profits. Of course, in many developing countries the government does have wage setting power, offering remuneration to both skilled and unskilled workers more generous than the private sector. This only worsens the problem.

Suppose a government job offers $(1+\rho)w_t$ for $\rho \geq 0$. Lets ignore differential biases and socialization efforts between parents who are employed in the private sector versus the public sector. In particular, suppose worker allocation in the two sectors is random so that f is the probability a worker would be hired by a private entity. Recognizing this, a parent imputes the expected labor earning $\tilde{w}_t = [1+\rho(1-f)]w_t \equiv \chi w_t$ where $\chi > 1$ whenever $f < 1$, to his non-entrepreneur offspring. We can then replace the wage rate in the payoff matrix in (17) by $\tilde{w}_t$.

[11] Impure altruism stems from three sources here. First is the paternalism bias, a preference for the child being of the parent's type. Secondly, there is an occupational bias that influences socialization intensity. Third is bounded rationality: parents use present, not future, wages, and their own business priors to evaluate their offspring's future earnings.

An alternative way to understand the role of culture is to imagine children automatically inheriting their parent's human capital. Then the proportion of wage-workers will always remain at μ_1 and culture would only matter because of history that created a high μ_1. This notion of culture as immutable is misleading. As the dynamic process underlying Boyd and Richerson's (1985) work demonstrates, within-family transmission is important in understanding the long reach of cultural biases.

Example 3. *Under the socialization cost from Example 1, both types of wage-working parents choose the same socialization effort*

$$\tau_t^w = (1-\mu_t)\ln\left[\frac{\delta_w \tilde{w}_t^{1/(1-\beta)}}{(1-\beta)\beta^{\beta/(1-\beta)}a^n(1-\sigma_\nu^2-\overline{x}_n)}\right]$$

while entrepreneurial parents choose

$$\tau_t^k = \mu_t \ln\left[\frac{\delta_b(1-\beta)\beta^{\beta/(1-\beta)}a^n(1-\sigma_\nu^2)}{\tilde{w}_t^{1/(1-\beta)}}\right]$$

in the long-run (when they have fully learned θ_n). In steady-state, since $\tau^w = \tau^b$, the rate of entrepreneurship implicitly solves

$$\ln\left(\frac{1-\mu^*}{\mu^*}\right) = \ln\left(\frac{1-\beta}{\beta}\right) + \ln f + \mu^* \ln\delta_b - (1-\mu^*)\ln\left[\delta_w \chi^{1/(1-\beta)}\left(\frac{1-\sigma_\nu^2}{1-\sigma_\nu^2-\overline{x}_n}\right)\right].$$

Conditional on the government hiring $1-f$ fraction of the workforce, the constrained efficient rate of entrepreneurship is one that yields the same expected return from entrepreneurship and private sector employment. This is given by $\mu^E = \beta/[\beta + f(1-\beta)] < \beta$, the dashed line in Fig 4. In addition to the previous effects of δ_w and δ_b, a higher public sector employment (lower f) and more generous public sector wages (higher ρ) both worsen the inefficiency.

This simple example surely understates the problem. If a better-paid public sector job is viewed as a sign of status, it creates additional movement away from entrepreneurship. One would need to distinguish between a pro-public sector and pro-private sector bias in this case and explicitly model the recruitment of public sector employees. That, in turn, opens the door for another inefficiency – rent-seeking, the purposeful cultivation of ties and talent to obtain better-paid public sector jobs. What this highlights is how a cultural norm, be it through colonial-era practices or post-independence emphasis on the public sector, can amplify the effects of policies and non-cultural institutions, effects that can persist for a while.

3 Choice of Technologies

The constant technology model from section 2 does not entertain growth in the long run or the possibility that newer entrepreneurs emerge from non-entrepreneurial families. We extend the previous environment to allow these.

First, potential entrepreneurs can choose from a menu of technologies (business activities) instead of a fixed and arbitrary n. In this we closely follow Jovanovic and Nyarko (1996). There is no direct cost of switching to a different technology and, as before, no cost to adjusting x. Each n

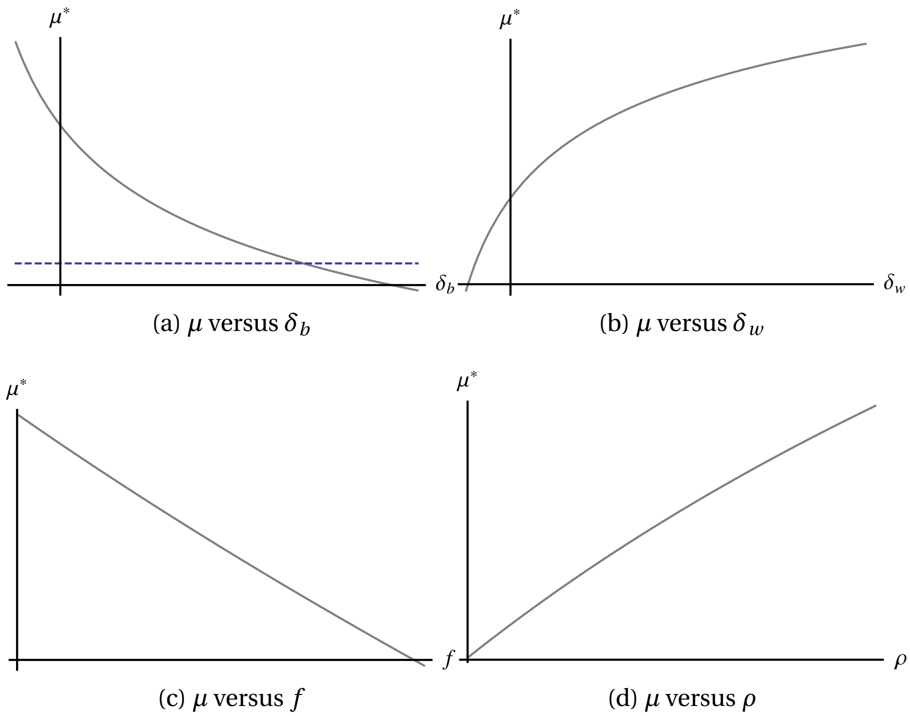


Figure 4: Entrepreneurship under Government Employment.
$\beta = 0.6, \delta_w = 6, \delta_b = 2, \sigma_v = 0.1, \overline{x}_n = 0.7, f = 0.9, \rho = 0.2$

is associated with the same functional form so that business capital is defined as in equations (4) and (5) but different technologies are imperfectly related. Specifically the parameters θ_n and θ_{n+s} for any n and $s \geq 1$ are linked by

$$\theta_{n+s} = \alpha^{s/2}\theta_n + \eta_s, \tag{26}$$

where η_s is drawn *iid* from $N(0, \sigma_\eta^2)$, $\alpha \in (0,1)$ and θ_n and η_s are independent. Observe that if $\alpha = 1$ and $\sigma_\eta^2 = 0$, then $\theta_{n+s} = \theta_n$ which means any precision about θ_n can be transferred to θ_{n+s}. Hence α is a measure of the specificity of human capital – how well knowledge of one business venture or technology helps in the next. For $\sigma_\eta^2 > 0$, of course, the entrepreneur faces some uncertainty in transferring his knowledge from θ_n to θ_{n+s} even for $\alpha = 1$. More generally α depends on factors, e.g. political capital, entry barriers, that create an advantage for the established business elite. Suppose that entrepreneurs cannot skip intermediate technologies when upgrading, that is, upgrading to $n+2$ is possible only via $n+1$ and not directly from n to $n+2$. This means the rate of technological progress, as long as some occurs, is exogenous. Finally note that $a > 1$ ensures that a higher n technology can yield higher expected profits.

We ignore public sector employment from now on and the preference side is similar to the benchmark model. In particular, we maintain the assumption of discrete initial priors but modify below the uninformed prior to be consistent with technology upgrading. For cultural indoctrination, it is necessary to specify which grade of technology is used to evaluate an offspring's payoff from entrepreneurship. Suppose the expected return from upgrading a technology is Π and from staying with the current technology π. Parental payoffs from being altruistic towards their offspring are

$$\begin{aligned}
V_t^{ww} &= \ln w_t \\
V_t^{wk} &= \ln\left(\max\left\{\Pi_t(x'), \pi_t(x')\right\}\right) - \ln \delta_w \\
V_t^{kk} &= \ln\left(\max\left\{\Pi_t(x_t), \pi_t(x_t)\right\}\right) \\
V_t^{kw} &= \ln w_t - \ln \delta_b.
\end{aligned}$$

where wage-workers are endowed with the prior x' and entrepreneurs with x_t at time t. These and the profit functions are fully specified below.

3.1 Updating and Upgrading

We begin by studying what an entrepreneur learns if he were to upgrade his technology compared to the one his entrepreneurial parent used. Recall from the previous section that continuous updating of information without changing the technology will lead to perfect mastery of that technology. In the presence of a menu of technologies distinguished by (26), upgrading to the next one causes posteriors to become more dispersed, that is, business expertise to be diluted, because the prior for vintage $n+1$ is $\alpha x_n + \sigma_\eta^2$.

First consider a hypothetical scenario of constant upgrading-without-updating. If this were to be repeated over time, the diffuse prior – which does not get sharpened through updating – evolves according to

$$x_{n+1,t+1} = \mathscr{J}(x_{nt}) \equiv \alpha x_{nt} + \sigma_\eta^2. \tag{27}$$

$\alpha \in (0,1)$ ensures that the fixed point of this mapping is a well defined $x' = \sigma_\eta^2/(1-\alpha) > 0$, independent of n. The greater the uncertainty surrounding new technologies, that is the higher is σ_η^2, the more diffuse is this long-run value. The absence of updating ensures that expertise remains weak. We assign this fixed point to be the diffuse prior of wage-workers, analogous to $\overline{x}_n$ in the baseline model. In other words, we are endowing wage workers with the "best of the worst" possible priors when a menu of technologies is available.[12] We also assume that the economy starts at $t = 1$ with technology n in use and a population endowed with the discrete priors x' and $\underline{x}_n < x'$. $G_1(\underline{x}_n)$ fraction of the initial population is indoctrinated as entrepreneurs, $1 - G_1(\underline{x}_n)$ fraction as wage workers.

When an entrepreneurial line is upgrading technologies besides updating priors, the evolution

[12]Assuming that the diffuse prior takes this particular value is not essential. All that is needed is for the prior to be sufficiently diffuse, above x^{**} (Lemma 1) and below $1-\sigma_\nu^2$, the latter opening up the possibility for indoctrination to be non-persistent.

of entrepreneurial human capital is described by

$$x_{n+1,t+1} = \mathscr{F}\left(\mathscr{J}(x_{nt})\right) = \mathscr{F}\left(\alpha x_{nt} + \sigma_\eta^2\right) \tag{28}$$

the fixed point of which, x^{**}, is the positive root of $\alpha x^2 + \left[(1-\alpha)\sigma_\nu^2 + \sigma_\eta^2\right] x - \sigma_\nu^2\sigma_\eta^2 = 0$. It is easy to show that $x' > x^{**} > 0$: even though a new technology is never fully mastered, updating generates sharper priors than without. Lemma 1 below summarizes these results and will be useful in establishing results later. Changes in the three fixed points referenced there and their relationship to other critical values of x drive the decisions that agents make on whether or not to work in accordance with their indoctrination and, as entrepreneurs, whether or not to upgrade technologies.

Lemma 1. *The fixed points of the mappings* $\mathscr{F}$, $\mathscr{F}(\mathscr{J})$ *and* $\mathscr{J}$ *are* 0, x^{**} *and* x' *respectively such that* $0 < x^{**} < x'$.

This model can generate a steady state where advanced businesses do not innovate, resulting in stagnation. The model of section 2 is therefore a special case of this one if we take $\overline{x}_n = x'$. This equilibrium can be shocked by changes in a, the rate of technological change or TFP, and α, the human capital specificity of different technologies. When this happens, existing entrepreneurs may start adopting more productive technologies or a new generation of entrepreneurs may do so and leap-frog over existing ones. Either way the economy moves from stagnation to endogenous growth.

To identify these results we present four parameter-dependent cases in Figures 5 and 6 below. The gray line in each figure indicates the equilibrium wage rate which strictly exceeds the payoff from entrepreneurship under the diffuse prior x'. The expected profit lines implicitly depend on the wage rate. For simplicity, the decision whether or not to upgrade is shown for the entire range of x.

3.2 Long-run Stagnation

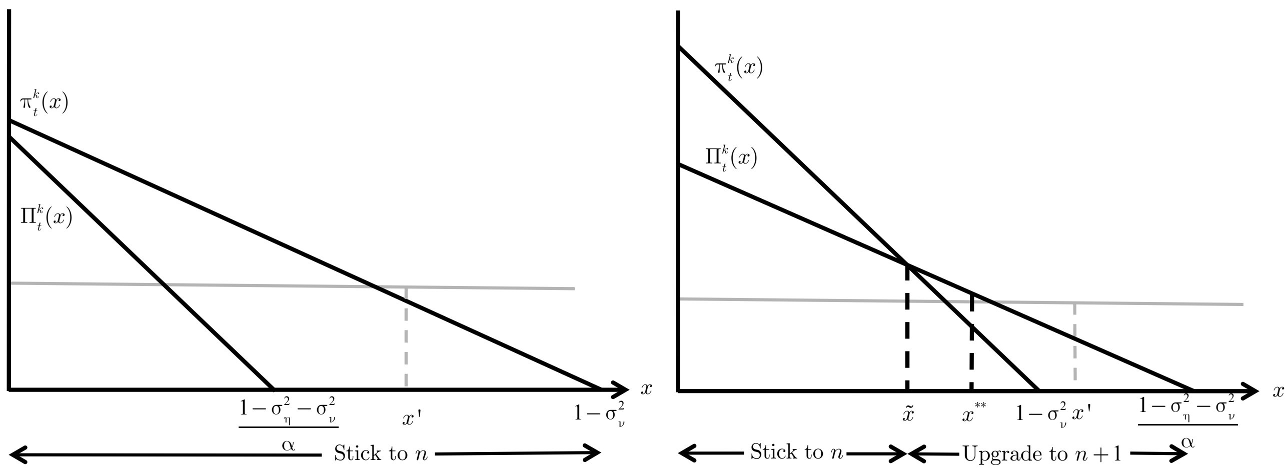
For an individual who has been culturally indoctrinated by the entrepreneurial line k, define $\Pi^k(x)$ as the expected payoff to switching to $n+1$ based on the expertise x that he has over technology n. Similarly, let $\pi^k(x)$ be the expected payoff to staying with n as before.

$$\Pi_t^k(x) \equiv E(\tilde{\pi}_{nt}^k | x_{nt}^k = x) = \kappa_t a^{n+1}(1 - \sigma_\eta^2 - \sigma_\nu^2 - \alpha x) \tag{29}$$

$$\pi_t^k(x) \equiv E(\tilde{\pi}_{t,n+1}^k | x_{nt}^k = x) = \kappa_t a^n (1 - \sigma_\nu^2 - x) \tag{30}$$

Because $\Pi^k(x)$ and $\pi^k(x)$ represent the expected payoffs to choosing technologies $n+1$ and n respectively, their ranking determines whether entrepreneur k will upgrade or not.

Long-run stagnation can occur in two scenarios, both illustrated in Figure 5 and formalized in the proposition below. Stagnation occurs when the productivity gain from switching (a) is relatively small and the optimum scale of a new technology is not easy to learn based on the old one (high σ_η^2). The two cases in Fig 5 differ in whether a new technology requires expertise sufficiently different from the old one (α) which, in turn, determines whether or not upgrading is worthwhile at any level of business expertise.



(a) $\Pi^k(0) < \pi^k(0), \quad \alpha a > 1$

(b) $\Pi^k(0) < \pi^k(0), \quad \alpha a < 1$

Figure 5: Technology Choice when $\Pi^k(0) < \pi^k(0)$

Proposition 3. *Suppose that* $\Pi_t^k(0) < \pi_t^k(0)$, *that is* $(1-\sigma_\nu^2) > (1-\sigma_\nu^2-\sigma_\eta^2)a$.

(i) If $\alpha a > 1$, $\Pi_t^k(x) < \pi_t^k(x)$ *for all* $x \geq 0$,

(ii) If $\alpha a < 1$, *then for some* $\tilde{x} \in (0, (1-\sigma_\eta^2-\sigma_\nu^2)/\alpha)$, $\Pi_t^k(\tilde{x}) = \pi_t^k(\tilde{x})$ *such that* $\Pi_t^k(x) < \pi_t^k(x)$ *whenever* $x < \tilde{x}$ *and vice versa.*

Fig 5(a) illustrates the case for Proposition 3(i): no matter what an entrepreneur's expertise (belief) is, the prevailing technology always dominates. No entrepreneur has any incentive to upgrade technologies which means the economy stays with n forever.

Suppose instead, as in Fig 5(b), we have $\alpha a < 1$, that is a lower value of α than above. Here an entrepreneur's expertise determines whether or not he is better off upgrading. An entrepreneur with a very low x, that is, a lot of expertise in technology n, will not want to upgrade because his substantial expertise in n does not readily transfer to $n+1$. The threshold $\tilde{x}$ is given by

$$\tilde{x} = \frac{a\sigma_\eta^2 - (a-1)(1-\sigma_\nu^2)}{1-\alpha a}$$

which is independent of time. Whereas for low values of x technology n dominates expected earnings, for a high value (still low enough to yield higher expected return over wage work) $n+1$ dominates. This means, if all entrepreneurs start off with minimally dispersed priors (low values of x), it is possible that *all* entrepreneurial lines keep using the vintage n without ever upgrading. Formally this requires, following the equilibrium outlined in section 2, that entrepreneurs start with a prior $\underline{x}_n \leq \tilde{x}$ corresponding to the initial technology n, and that a modified version of (A1) allowing for more than one technology holds

$$\beta < 1 - G_1(\underline{x}_n) < \beta \left[\frac{1}{\beta + (1-\beta)\gamma} \right], \tag{A3}$$

where $\gamma \equiv a(1-\sigma_\nu^2-\sigma_\eta^2-\alpha x')/(1-\sigma_\nu^2)$. Under (A3), all businesses will continuously update and eventually master technology n as in section 2, without ever upgrading.

In steady state, there will be a single entrepreneurial prior of $\underline{x}_n = 0$ and a single wage-worker prior of x'. Dynamic persistence in the no-growth steady state of section 2 required that wages be greater than the expected returns of an entrant who uses the current technology. Here, however, the potential entrant can now use technology $n+1$ besides n. Hence, dynamic persistence now requires that $w(\mu^*) > \max\{\pi^k(x',\mu^*), \Pi^k(x',\mu^*)\}$.

The outcomes from Fig 5(a) and Fig 5(b) under $\underline{x}_n \leq \tilde{x}$, (A3) and dynamic persistence are the same: no entrepreneur ever switches to a more productive technology than n. This means the economy converges to the stationary equilibrium of section 2 where aggregate output is constant, indoctrination is dynamically persistent (see section 3.4 below for details) and the supply of entrepreneurs is $1-\mu^*$.

3.3 Productivity Shock and Top-Down Development

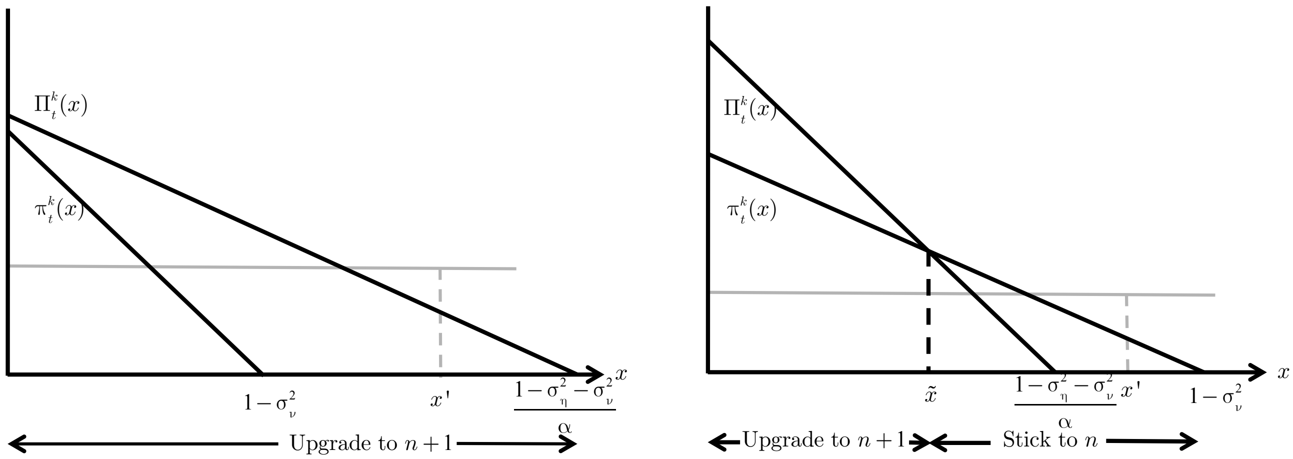
Depending on parameter values, it is possible to have a long-run equilibrium with growth and established entrepreneurial lines constantly upgrading their technology.

Proposition 4. *Suppose that* $\Pi_t^k(0) > \pi_t^k(0)$*, that is,* $(1-\sigma_\nu^2) < (1-\sigma_\nu^2-\sigma_\eta^2)a$*.*

(i) If $\alpha a < 1$, $\Pi_t^k(x) > \pi_t^k(x)$ *for all* $x \geq 0$*,*

(ii) If $\alpha a > 1$*, then for some* $\tilde{x} \in (0, 1-\sigma_\nu^2)$, $\Pi_t^k(\tilde{x}) = \pi_t^k(\tilde{x})$ *such that* $\Pi_t^k(x) > \pi_t^k(x)$ *whenever* $x < \tilde{x}$ *and vice versa.*

In Fig 6(a), corresponding to Proposition 4(i), the payoff from a new technology always exceeds that from the existing one no matter how precise or diffuse the entrepreneur's prior is. In this case, all entrepreneurs always upgrade. This scenario is more likely when the productivity gain from switching is large enough (high a), the optimum scale of the new technology is easy to learn based



(a) $\Pi^k(0) > \pi^k(0), \quad \alpha a < 1$ (b) $\Pi^k(0) > \pi^k(0), \quad \alpha a > 1$

Figure 6: Technology Choice when $\Pi^k(0) > \pi^k(0)$

on the old one (low σ_η) and, at the same time, the new technology requires expertise sufficiently different from the old one (low α). To see the last point, note that both Π and π decline monotonically with x. Since $\partial \Pi_t^k(x)/\partial x = -\alpha\kappa_t a^{n+1}$ while $\partial \pi_t^k(x)/\partial x = -\kappa_t a^n$, so long as $a\alpha < 1$, the marginal return to using a newer technology falls at a lower rate when x rises.

For a sufficiently high value of α as in Fig 6(b) and Proposition 4(ii), on the other hand, it is an entrepreneur with a lot of business expertise, $x < \tilde{x}$, who has an incentive to upgrade. Recall that entrepreneurs are endowed with the prior $\underline{x}_n$ at $t = 1$. If $\underline{x}_n > \tilde{x}$, no entrepreneur is sufficiently good at business for upgrading to be worthwhile – the economy would stagnate as in section 3.2 above. If instead $\underline{x}_n < \tilde{x}$, similar to Fig 6(a) all entrepreneurs keep upgrading their technology.

We use this framework – the contrast between Figures 5 and 6 – to identify what unleashes technological progress and growth in a developing country prone to, among other factors, an anti-capitalist cultural bias. Specifically, we start with the long-run equilibrium predicted by Fig 5 and ask whether and what kind of exogenous shocks might spur growth.

One natural candidate is a sharp change in technological or market access that improves overall productivity a and raises entrepreneurial returns from both existing and new technologies. Starting from the no-growth stationary equilibrium described by Fig 5(a), suppose a were to increase sufficiently such that $\Pi_t^k(0) > \pi_t^k(0)$, that is,

$$\left(1-\sigma_\nu^2-\sigma_\eta^2\right) a > 1-\sigma_\nu^2 \Leftrightarrow a > \hat{a} \equiv \frac{1-\sigma_\nu^2}{1-\sigma_\nu^2-\sigma_\eta^2}.$$

The threshold productivity level $\hat{a}$ is independent of cultural factors, that is, μ^*. If the productivity shock were to be higher than this threshold, the choice of technology would look like Fig

6(b).[13] That is, entrepreneurial lines would now prefer to upgrade rather than stay with their existing technology. Further, because this increase in a increases the marginal cost of diffuse priors, wage worker cultural lines prefer not to enter the business world. With all old businesses simultaneously switching from n to $n+1$, economic growth takes off without the creation of any new business lines. In this sense, culture ceases to be a constraint on economic growth: a sufficiently large change that improves overall productivity can tip the economy from stasis towards rapid change. The size of the productivity shock needed to tip the stagnating economy towards growth is independent of cultural inertia, so culture does not matter in this sense either.

Along the post-shock equilibrium path, constant updating and upgrading of technologies will cause all entrepreneurs' priors to converge to x^{**} over time. Each generation sees technologies upgraded by one step, so that if technology $r > n$ was being used in t, technology $r+1$ will be used in $t+1$. This means, in the new steady state, expected business capital for each entrepreneur

$$z_t^k = a^r \left[1 - \sigma_\nu^2 - x^{**}\right]$$

will grow at the (gross) rate a between any successive generations. There is no *net* learning in this steady state, that is, entrepreneurial priors remain at x^{**}, but there is some within-period learning. Business expertise x^{**} received from an entrepreneurial parent is only αx^{**} as valuable in the newer technology. On top, the presence of σ_η^2 means some uncertainty in applying that depreciated business expertise to the newer technology. In steady state, each generation of entrepreneurs learns exactly as much as needed to replenish the depreciated human capital and raise effective human capital back to x^{**}.

Finally, for the stationary equilibrium to exist, cultural indoctrination should also reach a steady state. This requires, from section 2, that the difference $V^{\jmath\jmath} - V^{\jmath\ell}$ for $\jmath, \ell \in \{k, w\}$ be constant. From (17) it follows that the wage rate will be growing at the same rate as expected entrepreneurial income whether at the informed (x^{**}) or uninformed (x') prior. Expected entrepreneurial income for any x is

$$\pi_{rt}^k(x) = a^r (1-\beta)\left(\frac{\beta}{w_t}\right)^{\beta/(1-\beta)} \left[1 - \sigma_\nu^2 - x\right].$$

For the ratio

$$\frac{\pi_{rt}^k(x)}{w_t} = \frac{a^r (1-\beta)\beta^{\beta/(1-\beta)} \left[1 - \sigma_\nu^2 - x\right]}{w_t^{1/(1-\beta)}}, \quad x \in \{x', x^{**}\}$$

to be constant, the growth factor of wages must be $a^{1-\beta} > 1$, equal to the growth factor of expected entrepreneurial income. With relative payoffs remaining stationary, indoctrination efforts are again given by equation (16) evaluated at these new relative payoffs, leading to a steady-state

[13]The cases where π^k lies uniformly above Π^k in Fig 5(b) and uniformly below in Fig 6(b) are omitted since their implications are similar to Figs 5(a) and 6(a) respectively.

indoctrination rate of $\bar{\mu}$ analogous to equation (25). The example below provides conditions under which this steady state is inefficient.

Example 4. *Using an approach similar to Examples 1 and 2 above, the steady-state $\bar{\mu}$ when entrepreneurs constantly upgrade technologies implicitly solves*

$$\ln\left(\frac{1-\bar{\mu}}{\bar{\mu}}\right) = \ln\left(\frac{1-\beta}{\beta}\right) + \bar{\mu}\ln\delta_b - (1-\bar{\mu})\ln\left[\delta_w\left(\frac{1-\sigma_v^2-x^{**}}{1-\sigma_v^2-x'}\right)\right].$$

As before, higher δ_w, lower δ_b and higher x' ensure that this is inefficient and it is inefficient for sure when $\delta_w = \delta_b = 1$. Setting $\overline{x}_n = x'$ in Example 2 implies $\bar{\mu} < \mu^*$: the upgrading-updating steady state is closer to the efficient outcome than the stagnation steady state. This occurs because both parental types exert lower socialization effort since $x^{**} > 0$ and the earnings ratio between the two occupations is not perceived to be as large as before.

In this steady state, aggregate output (and output per capita)

$$Y_t = \sum_k Y_t^k = \bar{\mu}^\beta(1-\bar{\mu})^{1-\beta}\left[a^r\left(1-\sigma_v^2-x^{**}\right)\right]^{1-\beta}$$

grows at the gross growth rate $a^{1-\beta}$ and the economy is on a balanced growth path (BGP). This growth rate is independent of cultural factors. Indeed it is the maximal growth rate possible when entrepreneurs can upgrade only one step ahead. Culture does determine the level of output per worker in the BGP because of the static inefficiency from $\bar{\mu} > \beta$. But it does not determine the size of the shock needed to generate growth. Furthermore, since $\bar{\mu} < \mu^*$, technological progress introduces a cultural change by itself and more become entrepreneurs. All these occur despite subjective occupational biases (δ_w, δ_b) remaining unchanged.

We conclude that culture is not predictive of long-term development: a large enough productivity shock can lead to economic growth, the growth rate and size of the shock being independent of culture.

3.4 Human Capital Shock and Overtaking

A more interesting growth takeoff, associated with social mobility and the emergence of a new economic elite, is possible too. Start again with the no-growth stationary equilibrium described by Figure 5 in section 3.2 with dynamically persistent cultural indoctrination. Suppose now that the economy experiences a human capital shock: a change in technology access or the regulatory environment that lowers the value of α.[14] Lowering α lowers the magnitude of $\partial\Pi(x)/\partial x$ while

[14] Of course in practice such a policy shock may also raise a. The BGP implications are similar, the difference being both incumbent and entrant lines may start upgrading depending on parameter values.

$\partial\pi(x)/\partial x$ is unchanged. That the marginal cost of a more diffuse prior falls when α falls means that indoctrination may no longer be persistent. In fact, to get a meaningful impact, let the decrease in α to α' be large enough that

$$\gamma(\alpha') > \frac{\beta(1-\mu^*)}{\mu^*(1-\beta)},$$

where γ is the expected entrepreneurial return from upgrading under a prior of x' relative to the expected return from staying with the existing technology for a prior of zero: $\gamma(\alpha) = a(1-\sigma_\nu^2-\sigma_\eta^2-\alpha x')/(1-\sigma_\nu^2)$. This implies that

$$\alpha' < 1-\sigma_\eta^2\left[1-\sigma_\nu^2-\left(\frac{1-\sigma_\nu^2}{a}\right)\left(\frac{\beta}{1-\beta}\right)\left(\frac{1-\mu^*}{\mu^*}\right)\right]^{-1} \equiv \hat{\alpha}\left(\mu^*\right),$$

the threshold $\hat{\alpha}$ increasing in cultural biases (that is μ^*). Therefore, higher the cultural inertia, the *smaller* the human capital shock necessary to overturn cultural indoctrination.

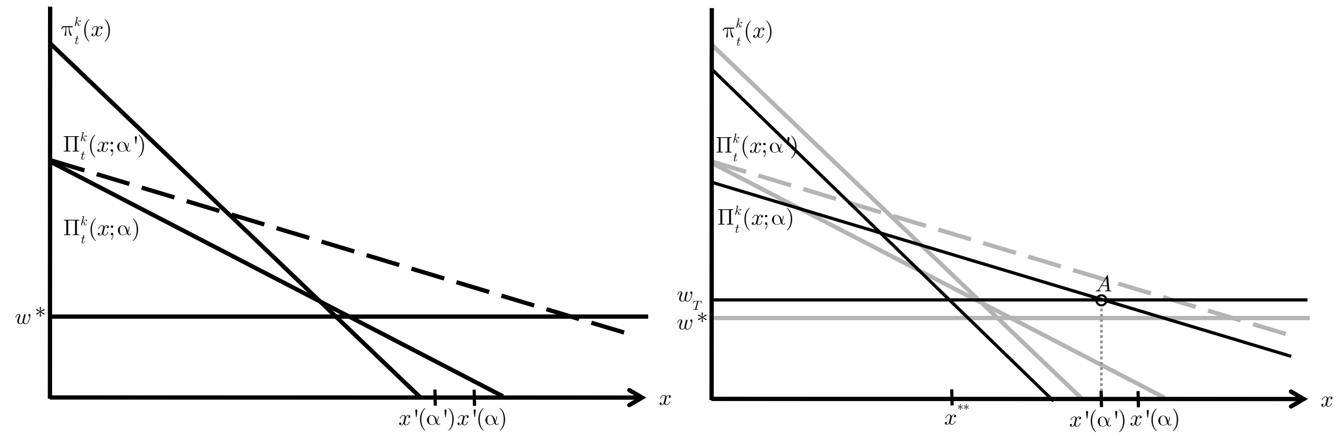
After the shock, individuals culturally indoctrinated to be wage workers expect higher returns from entrepreneurship despite their lack of business expertise. The ranking of $\pi_n(0)$ and $\Pi_n(0)$ is not changed by the change in α, so only the occupational choice of wage workers is initially affected. By Lemma 1 and Proposition 3, when α is lowered, the following ordinal ranking $\tilde{x} < x^{**} < x'$ (see sections 3.1 and 3.2) is maintained. Because only their ranking determines occupational decisions – as opposed to parental investment which is determined by cardinal measures – it is optimal for (some) wage workers to become entrepreneurs.

To identify the dynamic consequences, let us separate the occupational choice and cultural indoctrination of the first generation from subsequent ones.

First Generation

Start with Fig 5(b) and suppose that α falls to α' at the beginning of $t = T$ when indoctrination has already occurred but people are yet to make an occupational choice. We assume that the uninformed prior changes from $x'(\alpha)$ to $x'(\alpha') = \sigma_\eta^2/(1-\alpha')$ to reflect people's perception about the new environment (qualitative results are unchanged if x' does not change or changes with a one-generation lag). The post-shock economy, before equilibrium is restored, is shown in Fig 7(a). The dashed line represents the new Π_t^k corresponding to α'. At the previous uninformed prior $x'(\alpha)$, wages were strictly higher than both π_t and Π_t, so that none of the workers would have preferred entrepreneurship. Now at $x'(\alpha')$, expected entrepreneurial income from upgrading Π_t^k exceeds the wage rate but expected entrepreneurial income from the prevailing technology π_t^k does not.

This creates, for the first time, a separation between an agent's cultural line and his occupational choice. As culturally indoctrinated wage workers opt for entrepreneurship, it will drive up labor demand and down labor supply. This increases the wage rate w_T and decreases expected entrepreneurial returns for both of the n and $n+1$ technologies. Fig 7(b) shows – pre-equilibrium



(a) Post-indoctrination, Pre-Occupational Choice

(b) Post-Occupational Choice Equilibrium

Figure 7: The period-T problem when α falls to α'

relationships are in gray, equilibrium ones in black – that an occupational equilibrium is restored at point A where enough such people have opted for entrepreneurship using $n+1$ that the remaining workers are indifferent between the two occupations, that is, the wage rate and expected profits of entrant entrepreneurs are equalized. None of the culturally indoctrinated entrepreneurs switch to wage-work since they acquired perfect mastery over n from their cultural parents.

Denote the first-generation entrepreneurs, the entrants, by the set $\mathscr{E}_T^E$. Using the labor demand function from (2) and the arbitrage condition $w_T = \pi_{n+1,T}\left(x'(\alpha')\right)$, these entrepreneurs employ

$$L_T^k = \frac{\beta}{1-\beta} \ \forall k \in \mathscr{E}_T^E \tag{31}$$

units of labor. The relative return between an incumbent and entrant's businesses, γ_t, is

$$\gamma_t(x_t) = \frac{a^{t-T+1}(1-\sigma_\nu^2-\sigma_\eta^2-\alpha' x_t)}{1-\sigma_\nu^2} \text{ for } t \geq T \tag{32}$$

where we use the result – see Fig 7(b) – that along the transition path entrant entrepreneurial lines will keep updating their technology. Incumbent entrepreneurial lines who were employing $\mu^*/(1-\mu^*)$ units of labor before the shock, now hire

$$L_T^k = \frac{\beta}{(1-\beta)\gamma_T} \ \forall k \in \mathscr{E}_T \backslash \mathscr{E}_T^E. \tag{33}$$

This labor demand is lower than before, since the entry of first-generation entrepreneurs raises the wage rate. The end result of this post-shock equilibrium is $\mu_T < m_T$, a decline in business returns for existing entrepreneurial lines and the rise of a new class of entrepreneurs who are, initially, no better off than wage workers.

By the end of T, three groups of people have emerged: those indoctrinated as workers and chose to be so, those indoctrinated as workers but chose to venture into entrepreneurship and those indoctrinated as entrepreneurs who chose to be so. We will refer to the last group, that is, those culturally indoctrinated and choosing to be entrepreneurs with priors $x_n = 0$, as incumbents. Denote by i_t the fraction of the population indoctrinated into incumbent entrepreneurship (that is, those acquiring the prior 0) and by ι_t the fraction who choose to be (incumbent) entrepreneurs. We have $i_T = \iota_T$.

Refer to the other group of entrepreneurs and their progeny (that is, those emerging from first-generation entrepreneurs) as entrants even though by $T+1$ they are no longer first-generation entrepreneurs. The key difference between these two groups of entrepreneurs is their business expertise and, thus, technology choice. Denote the fraction of the population culturally indoctrinated in entrant entrepreneurship by e_t and the actual fraction who choose to be entrepreneurs by ϵ_t.

As before let the fraction of generation t who were culturally indoctrinated in wage work be m_t and the fraction who become workers be μ_t. Using these definitions the proportions of each of the three types in T are

$$\begin{aligned}
\iota_T &= i_T = 1-\mu^*, \\
\epsilon_T &= \mu^* - \left(1-\mu^*\right)\left(\frac{\beta}{1-\beta}\right)\frac{1}{\gamma_T}, \qquad (34)\\
\mu_T &= \mu^* - \epsilon_T.
\end{aligned}$$

Three kinds of human capital are intergenerationally transmitted. Incumbents culturally pass along priors of $x_n = 0$ to every generation ($\tilde{x} > 0$ still holds), entrants culturally pass along $x_{n+t} \in [x^{**}, x'(\alpha')]$ gradually moving from $x'(\alpha')$ to x^{**} through constant upgrading and updating, and wage workers culturally transmit their diffuse prior $x'(\alpha')$.

Second Generation and Beyond

Specify the altruism payoffs as

$$\begin{aligned}
V_t^{ww} &= \ln w_t \\
V_t^{wk} &= \ln\left(\Pi_{t+1}(x')\right) - \ln\delta_w \\
V_t^{ee} &= \ln\left(\Pi_{t+1}(x_t^e)\right), \\
V_t^{ii} &= \ln\left(\pi_t \middle| 0\right), \\
V_t^{kw} &= \ln w_t - \ln\delta_b,
\end{aligned}$$

where we distinguish between incumbent and entrant entrepreneurship, $k \in \{i, e\}$, because their human capitals differ. Since a wage-working parent projects his own prior and choice problem onto his offspring, his evaluation of whether the offspring becomes an entrant entrepreneur (acquires x^e_{t+1}) or an incumbent entrepreneur (acquires $x^i_{t+1} = 0$) is the same. For $t \geq T$, within-family socialization efforts of the three types of parents are

$$\begin{aligned}
\tau^w_t &= (\psi')^{-1}\left[(1-\mu_t)\left(V^{ww}_t - V^{wk}_t\right)\right] \\
\tau^e_t &= (\psi')^{-1}\left[\mu_t\left(V^{ee}_t - V^{kw}_t\right)\right] \\
\tau^i_t &= (\psi')^{-1}\left[\mu_t\left(V^{ii}_t - V^{kw}_t\right)\right].
\end{aligned}$$

As before these are increasing in the perceived payoff differential and decreasing in the frequency of own occupational type. Indoctrination by the two entrepreneur-types differ only because of their perceived earnings differential.

Since wages and expected entrepreneurial income for entrants are equalized in $t = T$, a wage worker will behave (from paternalism bias) as if his child on becoming a first-time entrepreneur will see no change in expected income. Likewise a first-generation entrepreneur parent will surmise that his child becoming a wage worker will not alter his income. Both types of parents therefore indoctrinate their children based only on their occupational biases, δ_w and δ_b. This results in a low level of parental investment from these groups. On the other hand, despite seeing their business returns drop, incumbent cultural lines will still view any movement towards wage work as a drop in their offspring's income. They will invest more intensively in cultural indoctrination than the other groups (indoctrination effort, though, will be lower than before because of lower business earnings), thereby increasing the frequency of their cultural trait in the population.

This means, initially at least, entrant entrepreneurs are dominated in numbers by incumbent ones. But as long as the indoctrination effort by entrant entrepreneurs is positive, and it will be under the model's assumptions, at least some entrant lines will be maintained in the population. Just like the established entrepreneurs of section 3.3, these entrant entrepreneurs will be constantly upgrading and updating while the incumbents stay with the existing technology. This has two effects. First, since $a > 1$ and $\tilde{x} < x^{**} < x'$, after sufficient technology upgrading and updating, new technologies will yield higher expected earnings than n. As entrants' priors fall with each upgrading and updating, their productivity rises faster than that of incumbents. Thus their indoctrination effort will come to dominate that of incumbents'.

Secondly, rising labor demand from the entrants keeps raising the wage rate, steadily eating into the profits of the incumbents. Eventually wages increase so much that at some $t = T' \geq T$, $w_{T'} = \pi^k_{T'}(0)$. After some $T'' \geq T'$, incumbent entrepreneurs find it no longer worthwhile to continue in their line of work and those cultural lines are wiped out as their offspring choose *en masse* to become wage workers.[15]

[15]Since the ranking of $\Pi^k(0)$ and $\pi^k(0)$ does not change, neither does it ever become worthwhile for incumbent lines to upgrade to the $n+1$ technology; recall that only one-step ahead upgrading is permissible. It is possible to

The BGP characteristics of this economy are similar to that of the previous section: growth is driven by continuous technology upgrading and the fraction of wage workers is equal to $\bar{\mu}$. So long as assumptions (A2) and (A3) hold for $\bar{\mu}$, the result will be a monotonic, dynamically persistent movement toward $\bar{\mu}$ after T', with discrete priors $x_{n+t} = x^{**}$ for entrepreneurs and x' for wage workers. The key difference from before is that growth here is driven entirely by entrant entrepreneurial lines. The example below illustrates how overtaking can occur from a human capital shock.

Example 5. *For the socialization cost function from Example 1, socialization efforts are*

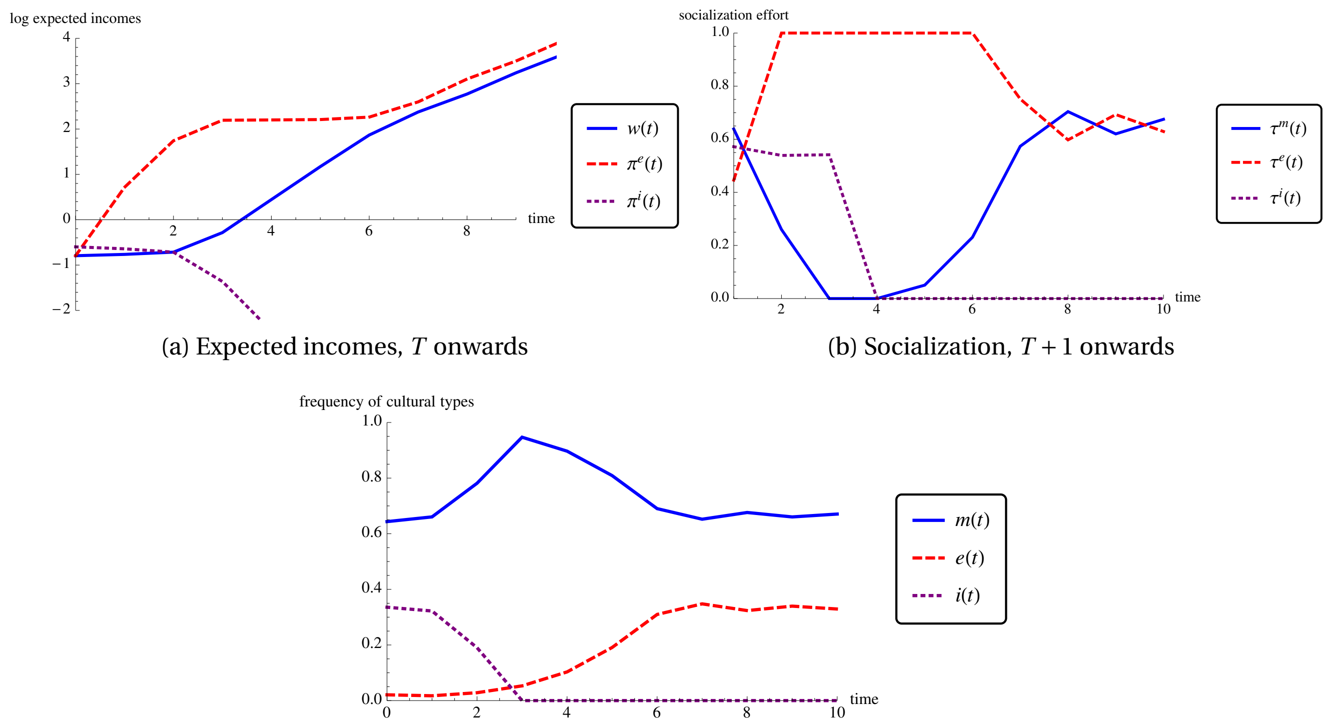
$$\tau_t^w = (1-\mu_t)\left(V_t^{ww} - V_t^{wk}\right)$$
$$\tau_t^e = \mu_t\left(V_t^{ee} - V_t^{kw}\right)$$
$$\tau_t^i = \mu_t\left(V_t^{ii} - V_t^{kw}\right).$$

As before these are increasing in the perceived payoff differential and decreasing in the frequency of own occupational type. Figure 8 presents an example of overtaking. The pre-shock human capital parameter is set to $\alpha = 0.3$ *to produce a naive prior of* 0.7 *as in the previous examples. The shock lowers this to* 0.25 *in some initial period, normalized to zero in the figure.*

Figure 8 illustrates the time path of occupational (expected) income, socialization effort and occupational frequency in the population. In the initial period, socialization by incumbent families dominates that by entrant and wage-working families. As long as non-upgrading incumbents are present, wages increase at a slower rate than entrant entrepreneurial profits (Fig 8a). Since their earnings rise faster than wages, from period 1 *onwards, entrant families invest more intensively in cultural indoctrination (Fig 8b). This ensures that their frequency rises faster than that of incumbent entrepreneurs (Fig 8c). In the third generation (*$t = 2$*), some but not all of the incumbent entrepreneurial lines opt for wage work and the wage rate is pinned down by an arbitrage condition between incumbent entrepreneurship and wage work during this period (Fig 8a). By the fourth generation (*$t = 3$*), wages have risen high enough that all incumbent lines switch to wage-work and their human capital dies out.*

Steady state is reached when wage-workers' and entrant entrepreneurs' socialization efforts converge and their incomes increase at the same rate, 1.8% per year if a generation is taken to be 25 years. The steady-state proportion of entrepreneurs in this example is 0.45*, slightly higher than the* 0.44 *before the shock, and consisting entirely of "first generation" entrepreneurs.*

have $T'' > T' + 1$, that is, several generations during which an arbitrage condition equalizes the expected returns from incumbent entrepreneurship and wage work. With each successive generation after T', more and more incumbent entrepreneurial offspring choose to become wage workers, until eventually all do. It is also possible, if α' is low enough, for overtaking to happen within one generation, that is by T itself.



(a) Expected incomes, T onwards

(b) Socialization, $T+1$ onwards

(c) Evolution of types, T onwards

Figure 8: Overtaking
$\beta = 0.6, \delta_w = 6, \delta_b = 2, \sigma_\nu^2 = 0.1, \sigma_\eta^2 = 0.49, a = 3, \alpha = 0.3, \alpha' = 0.25$

In conclusion we note that here too cultural change occurs despite unchanging cultural biases (δ_w, δ_b). Additionally, the size of the shock necessary to tip the economy towards growth is *inversely* related to cultural inertia. Family background matters least when there is a human capital shock and the steady-state entrepreneurial lines all emerge from a non-entrepreneurial background. Hence culture is not predictive of long-run growth: economic conditions can provide a sufficiently strong impetus to create a pro-capitalist culture that takes the economy from stagnation to sustained growth.

4 Discussion

An advantage of the model's relatively simple specification of pro-capitalist culture is its ability to broadly inform us about the development path of several societies and the consequences of "opening up". We discuss three examples. The case of India is one of growth takeoff fueled partly by an endogenous cultural response, the emergence of a new class of entrepreneurs. We consider how colonial policies in India biased the population towards safer occupations, an argument extended to colonial Africa in the second example. The third example, on Japan and South Korea, shows the scope of top-down development arising from forced cultural and economic change.

4.1 The Long Shadow of Colonialism

The diverse development paths taken by former European colonies in Africa, North America and Australasia have attracted much research in recent years. A compelling line of work highlights the extractive nature of some colonies. It is argued that the effects of colonization have persisted in the form of inferior political and economic institutions long after the departure of the colonists (Acemoglu and Robinson, 2012).

Not all countries fit this general pattern and the appropriateness of specific institutions can be hard to identify *ex ante*. A feature common to most former colonies excepting the western offshoots, however, is the pursuit of state-led development soon after independence. In part, the Soviet Union's rapid industrialization was seen as a model worth emulating by many of these countries. The policy choice also reflected in part a deep distrust of the forces of capitalism. Whether consciously or as a by-product of global trade, colonization had often led to the decimation of local industries, voracious resource extraction and non-development of domestic industries with local entrepreneurs confined to trade and commerce. The decision to pursue state-led development stemmed from the belief that market-based development would be rapacious, ill suited to tackle chronic poverty.

The model provides some insight into how the cultural impact of colonization, complementing the effect on political institutions, shaped national identities and economic development. Take the case of India, whose independence from Great Britain in 1947 was embraced with much focus on nation-building and a development strategy implemented through five year plans. After an initial spurt, growth of output per capita faltered, averaging only 1.7% per year during 1950-80 even as Asian economies like Japan, South Korea and Taiwan were showing much dynamism. The institutionalist explanation for this is weak: "in 1980, India's level of income was about one-fourth of what it should have been, given the strength of its economic institutions. On the other hand, if political institutions are the true long-run determinants of income, India's income is about 15 percent of what it should be" (Rodrik and Subramanian, 2005, p. 219).

Even though India's economic policies were not explicitly socialist in the early decades after independence – liberal even compared to the overtly restrictive policies that were to follow from the mid-1960s – the overarching theme was state-led development using directed investment (especially in heavy industries) and manipulated prices (Panagariya, 2008). The task of administering a large country fell on the shoulders of the administrative service, a carryover from the British era civil service. Public servants were also necessary for the expansion of the public sector. Soon the government was providing employment not just to the educated and skilled but also the relatively less skilled workforce in public sector enterprises and in federal, state and local bureaucracies. By 1961 the public sector accounted for close to 58 percent of the total organized sector employment, a number that increased to 68 percent by 1981 before reversing in the 1990s (India Labour Market

Report, 2008).[16]

One way to understand India's colonial legacy is to recognize that, out of necessity, the British promoted certain kinds of educational training and role models. In this framework, entrepreneurs, by engaging in uncoordinated activity, created unaccounted and uncontrolled wealth, whereas a bureaucratic system of production lent itself optimally to administration and control. In creating an employment and social structure dedicated to bureaucracy, the colonial government created a value system where securing a government job – rather than striking out on one's own – was perceived as success and ensured membership in an emerging educated elite. That public sector jobs – public sector wages often increased faster than the inflation rate or private sector wages – were better paid and secure made it a great attraction for college graduates and the less skilled. From the mid-1960s, restrictive licensing policies were used to give preferential credit and foreign exchange access to large-scale enterprises, many in the public sector. In conjunction with tighter labor market regulations, these policies stifled a more entrepreneurial base of smaller industries from diversifying and growing. Lal (1999b) conjectures that:

> "The contempt in which merchants and markets have traditionally been held in Hindu society was given a new garb by Fabian socialism which appealed to the newly westernized but traditional literary castes of India" (p. 36),

an argument closely related to Weber's (1958) thesis on the caste system. The resulting high δ_w and low δ_b would have meant a sizable fraction of the population locked into safer occupations, many in the public sector. That was no doubt worsened by a high α implied by preferential access granted to insiders and the bureaucratized, centrally coordinated nature of production.

Beyond this intensification of cultural biases and its growth implications, our model is particularly useful in understanding India's growth recovery. Contrary to popular perception, this recovery does not start with the 1991-92 liberalization necessitated by a balance-of-payments crisis, but predates it to the piecemeal reforms initiated during the 1980s (Delong, 2003, Rodrik and Subramanian, 2005, Panagariya, 2008). Rodrik and Subramanian (2005) empirically distinguish between the two periods. They argue that while the growth recovery of the 1980s was due to a pro-business "attitudinal shift" that favored the interests of existing businesses, as in the case of South Korea following General Park's takeover, the reforms of the 1990s are seen as pro-market, making possible the emergence of new, dynamic firms. By 1999, 8 of the top 10 Indian billionaires were first generation entrepreneurs, and 6 of the top 10 had made their fortunes in knowledge industries (Das, 2000). Indeed, post-liberalization, "middle class" entrepreneurs have often entered sectors

[16]As a share of the total workforce, public sector employment has been much lower. More than 90% of Indian workers were employed in the unorganised sectors as recently as the late 1990s. The remaining 10% in the organized sector, though, produced nearly 40% of national income (Bhalla, 2003). In other words, despite accounting for a small share of overall employment, the public sector has been an overwhelming presence when it comes to better-paid jobs, particularly for the educated workforce.

and industries that were made possible by liberalization (information, biotechnology) or relatively untouched by existing ones (travel and hospitality).

Following the discussion in section 3 there are two ways to interpret a "liberalization shock": as an exogenous increase in the TFP parameter a for all technologies, or as an increase in the same accompanied by a reduction in the human capital specificity parameter α. Viewed this way, while the earlier liberalization of the 1980s was mainly about favoring existing businesses – higher a alone – that raised growth without seeing the birth of a new generation of entrepreneurs, that of the 1990s was more disruptive, forcing the economy to confront the global economy and making available new entrepreneurial opportunities. This may also explain why the liberalization of 1991 has remained robust – making way as it has to shared prosperity by the middle class and the established elite – contrary to an earlier episode in 1966 that was soon reversed (Srinivasan, 2005).[17]

The essential contours of this story – the slant towards public sector jobs and a cultural bias away from entrepreneurship – apply to colonial Africa too. Indirect rule, which the British perfected in India, was extensively applied to its African colonies. Lacking a sufficient number of British officials to adequately administer the colonies, the British relied on Africans who were either traditionally-recognized leaders such as chiefs or newly-trained technocrats who would work as middle men. The system created a set of native administrators, public education systems and easily identifiable characteristics such as western education, Christianity and western attire that set apart the educated African. That educated African was not only aiding the colonial enterprise in his capacity as a government clerk, a teacher or an administrator, he was also projecting a modern image for rest of society to value and emulate. Ekeh (1975) articulates this cultural impact:

> "… central to the ideological promotion of the legitimacy of the colonizers in Africa, is the pervasive emphasis on the distinction between 'natives' (that is Africans who have no Western education) and Western educated Africans.… To become a Western educated African in the colonial situation was for many an avenue for escaping hard work.… To send one's son to school was to hope that he would escape the boredom of hard work." (p 99)

Both the British and the French actively encouraged this value system which achieved "maximum expression" in the former's doctrine of indirect rule.[18] Given the demands of empire, these edu-

[17]Standard models of human capital transmission within the family do not explain this kind of overtaking as there is no scope for some types of human capital to be better at certain technologies than others. That is not to say ours is the only explanation for overtaking (e.g., see Hassler and Mora, 2000). The Indian case can also be understood as a sector-specific productivity shock where entrepreneurs differ in their sector-specific skills. Where our contribution is novel is to show that the same economy that was once held back by *cultural factors* – recall from section 3.2 that the economy can stagnate despite access to a menu of technologies if cultural biases are strong and TFP low – is capable of dynamism under appropriate conditions, culture no longer a constraint on its development.

[18]While indirect rule was an explicit part of British colonial policy, the French practiced direct rule. Even so, the latter's administrative presence was quite thin: 1:27,000 ratio of colonial administrators to the population in French West Africa and 1:35,000 in the Congo compared to 1:19,000 in British Kenya (Kirk-Greene, 1980).

cated Africans faced certain and attractive employment in government administration versus very uncertain private business opportunities, and these government employment opportunities for aspiring Africans helped shape their post-colonial value systems.

Somewhat differently from the Indian case, on the other side of the equation was the colonial attitude towards African workers. While the British had traditionally encouraged a "practice oriented" education in its African colonies, its education policy became more proactive from 1947 when the Colonial Office "firmly committed itself to a modernist project: focusing on educated Africans, bringing them into local government and involving them in development projects, using them as the key agents to bring social change to rural areas" (Cooper, 1996, p 214). Concurrently there was a push towards developing a stable working class in British as well as French Africa, the attitude being "workers had to be socialized into their new roles and had to be paid enough to encourage stability in the job and to bring up a new generation of workers in a suitable physical and cultural milieu" (Cooper, 1996, p 453).

It is clear that entrepreneurship was far from the colonialist's mind as entrepreneurial Africans would have been less likely to be controlled, not just less essential to the colonial enterprise. These attitudes, as they percolated into the cultural consciousness over time, would have made wage work and public employment relatively more attractive and given the workforce tied in relatively low risk administrative jobs a comparative advantage vis-a-vis entrepreneurship. We can think of this post-colonial situation as one in which the colonialist endeavor created a status quo bias: a population dedicated to the safe use of a well-worn technology and a working class that sees little gain from entering into entrepreneurship. The result is an economy – with little growth of income or entrepreneurship – sustained simultaneously by policies that make entry into entrepreneurship difficult (high α) and the successful mastery of current technologies whose growth potential has been exhausted. Only a shock to total factor productivity (a) or to the human capital specificity of technology (α) can nudge this economy towards growth.

4.2 Japan and South Korea

Japanese society before the Meiji era is an instance of socio-economic stagnation, a focus on stability and wealth accumulation solely from population growth. The source of this was as much politico-economic as cultural. According to the historian E. Herbert Norman, the Tokugawa period was "one of the most conscious attempts in history to freeze society in a rigid hierarchical mold" (Norman, 1940, cited in Lockwood, 1968, p. 5). Landes (1998) describes the prevailing climate similarly: "Japan had had enough of discovery and innovation [...] The aim now: freeze the social order, fix relations of social and political hierarchy" (p. 356). Infanticide among the peasant population was opposed vociferously by the daimyo on expressly amoral grounds because growth of that population was a major source of wealth creation and preservation for the nobility (Honjo, 1935). It is easy to see that, in the model, the only way for entrepreneurs (broadly speaking, the elite) to become richer in a stagnating economy is for the working population to procreate faster, depressing wages and raising profits.

The Shogunate did away with the procedure of taking land from feudal lords who died without a male heir, sacrificing enormous future land transfers, in order to do away with ronin, masterless samurai who were a source of significant political dislocation (Landes, 1998). Along with proscriptions against foreign interactions, there were prohibitions on the use of high-quality soil for the production of cash crops and for villagers seeking non-agricultural work.[19] These cultural and economic policies can be understood in our framework as an attempt to maintain and master existing modes of production and create wealth for incumbents without potentially upsetting their privileges.

Between 1852 and 1854, Commodore Perry led an expedition to Japan, in which he used several advanced warships to coerce the Shogunate into accepting open diplomatic contact and the removal of all trade barriers with America. Driven by a perception of the military necessity of economic reform, a deep cultural revolution followed in Japan. A society accustomed to and proficient in existing technologies was confronted by a regime in which competition and innovation were extolled, embodied by the slogan *Fukoku kyohei*, "enrich the economy to strengthen the army" (Smith, 1988, p 259). During this period, the Meiji Restoration, economic growth was stimulated by agricultural liberalization that allowed the introduction of new techniques and use of existing land for crops other than rice. The system of privilege by which merchants and high-ranking samurai attained wealth during the Tokugawa era was also ended (Macpherson, 1995). Silk and other cash crops were grown on land which had previously been employed to produce rice. This transformation was largely due to the Land Tax Reform of 1873 which overturned the idea that cash was to be kept out of the hands of all save merchants (best exemplified by the slogan *kikoku-senkin*, "revere grain, despise money") and allowed transactions to be carried out in cash for the permanent transfer of land. Land transfers allowed plots that had been divided up into five or fewer acres, ideal for rice cultivation, to be consolidated for activities such as sericulture. The exposure to Western technology also brought the application of phosphate fertilizers.

This agricultural revolution was the primary source of financing for subsequent industrialization and provided a wellspring of entrepreneurs (Macpherson, 1995). Growth was characterized by the outsized role of the existing elites (samurai and merchants), some scholars going so far as to describe it as an aristocratic revolution in response to the new opportunities (see also Smith, 1988):

> "In a society that valued nothing higher than personal loyalty, disaffected elites could

[19] "... a village could be punished for failing to get the maximum amount of production from its land, planting commercial crops on land assessed as taxable rice land [all land which had been under cultivation during the last tax assessment], or neglecting farming in favor of other occupations" (Jansen, 1980, Ch. 9).

set higher authority – the emperor (Tenno) and the nation – above their lord and the shogun above him, without being disloyal. They could make a revolution without being revolutionaries." (Landes, 1998, p. 372)

Within our model these changes either lowered α by lowering the power of rank and privilege (a form of political, if not human, capital) or raised a, the access and return to newer technologies. A reduction in the power of privilege meant cultivating government contacts was less essential to commercial activity. This would have made it easier for potential entrants and given less of an edge to incumbents with the most experience and, therefore, the most contacts. In either case, the theory predicts a shift from stagnation to long run growth but through different channels. That the elites were the ones to have led Japan towards modernization suggests that the second channel, the sudden access to western institutions and technological knowhow, was more instrumental.

Korean society before Japanese colonization (1910-1945) was in many ways similar to Tokugawa-era Japan, with a strong focus on the status quo (Jones and Sakong, 1980) and pressure from the nobility to expand population. Under the colonial government, most profitable opportunities were limited to the Japanese. This structure gave way in the post-independence years to an economy with little economic growth or entrepreneurship until the Park regime. One of General Park's first major actions on the domestic front after the coup of 1961 was to imprison business leaders, allegedly for corruption. They were all eventually released after agreeing to his economic plans.[20]

The growth that followed was spurred in large part by Park's demands that businesses engage in new activities that were deemed to be of industrial importance. Originally, this growth was autocratically demanded from the top down and firms received explicit or implicit subsidies. As time went on, firms were successfully weaned and began engaging in new ventures without state request. This growth was primarily driven by firms like Samsung that had explicitly agreed to Park's industrial strategies. Indeed, Korean entrepreneurs and major businesses during this period were predominantly descendants of the elites of previous eras (Jones and Sakong, 1980). In our model this is to be interpreted as a forced upgrading of technology, a movement that would not have been privately optimal had it not been for the threat of political retribution. Subsequently, as Korean businesses gathered sufficient expertise, technology upgrading came to be in their strict economic interest.[21]

[20]The founder of Samsung, Lee Byung Chull, who was abroad at the time of the arrests had to commit to Park's economic program to avoid imprisonment on his return.

[21]This story is at best incomplete – many other countries that followed a top-down approach to economic policy floundered. See Rodrik (1995) for a complementary explanation based on coordination failures.

5 Conclusion

Using a model of intergenerational cultural transmission of human capital, this paper has studied the evolution of culture and economic development. Risk-neutral individuals work in one of two occupations, operating a business whose expected return depends on business expertise or working for a guaranteed wage. Parental comparative advantage in entrepreneurship is culturally transmitted to children through costly, but imperfect, intra-family education. This human capital determines occupational choice. Experience in a particular occupation also imparts an occupational bias that affects intergenerational transmission.

Various patterns of economic development, from long-run stagnation to sustained growth to leap-frogging in economic status, are possible. Culture – occupational bias and the intra-family transmission of human capital – can lead to stagnation in the long run when productivity growth is relatively small or past policies were geared towards safer occupations. For sufficiently high productivity gains from technological change or sufficiently low human capital specificity of new technologies, culture becomes irrelevant for long-run growth though it is still associated with static inefficiency. In this the model's implications are similar to Krugman (1991) where history turns out to be decisive only when the rate of inter-sectoral adjustment, and hence economic growth, are slow.

There are three directions in which the present work may be extended. While occupational biases are taken to be immutable, they may be endogenous to the economic fortune of different sectors. Allowing parents to indoctrinate their children in an occupation different from their own and to alter their own biases depending on market outcomes would be one way to study how the social esteem with which certain occupations are held changes over time. Secondly, there are likely complementarities between entrepreneurship and the pace of technological progress. An innovation or adoption process that endogenizes the productivity gain from new technologies, for example if technologies can be upgraded by more than one step, could yield different implications for the growth rate which, at present, is independent of culture in a growing economy. In yet another respect culture may be more deterministic than the growth equilibrium suggests. Our model of entrepreneurship does not include credit frictions that discourage risk-taking and entry of productive businesses. By creating additional barriers into entrepreneurship, credit market imperfections would heighten cultural inertia.

The lesson from our work is not that culture never matters, only that it does not always. Even when culture is not predictive of long-term development – the transition from stagnation to sustained growth – as in the model, it may matter for differences in the income level across societies. This distinction is useful to keep in mind in culture-based explorations of present-day underdevelopment and long-term development.

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