Culture and Market : A Macroeconomic Tale of Two Institutions

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Abstract

Historically, culture has played an important role in economic development and the link between the two has established to be bidirectional. In this paper, in an overlapping generations framework, we model endogenous evolution of cultural as occupational traits passed on from one generation to another. Certain occupations have a public spirit attached to them and therefore require motivated agents who can serve well in these occupations. These traits that have been transmitted from one generation to another interact with the market returns. In the presence of these interactions we show that the economy can end up in a low growth - low inequality trap in the long run. We also show that in the long run, the role of culture ultimately becomes void.

1 Introduction

The role of value systems, norms, institutions and culture has been established in the past in the field of economic analysis. Economic historians have argued that culture and institutions were the prime rationale for explaining the origin of industrial revolution in Britain. The idea of culture is one, that is hard to precisely define. There is no consistent definition for this concept. The definition varies from one context to the other. In our work,we consider culture to be the sum of attitudes, customs, and beliefs that distinguishes one group of people from another, which is transmitted across generations through language, material objects, social interactions and art. It is not hard to observe that culture as defined above, has bearing on economic activities through it's influence on labour force participation, savings

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behaviour and capital accumulation, education,entrepreneurial spirit, risk taking behaviour and technology adoption to name a few. It has been documented in the literature that certain episodes in the history point out to the strong link between economy and culture. Putnam et al (1993) argue that historical reasons of establishing a free state and fighting against the emperor established a notion of trust among the citizens of Northern Italy which has resulted in developed social structures in these city states. Another set of observations contrast the US with countries in Europe in terms of their entrepreneurial culture and also in their collectivist behaviour with the former being an individualistic one and the latter being a collectivist one. These differences in culture could be the reason that these two are on different development paths and levels.

Beginning with Smith and Marx who in their path breaking work asserted the importance of social and cultural factors in the economic framework, the role between the two was later taken forward by Weber (1905) in his seminal work on the role of protestant ethics in the industrial revolution affirms the link between these two systems to be a bi-directional one. He stated that the culture is not just a consequence of economic outcomes but also the economic events having a bearing on the cultural environment. This link between culture and economic development has more recently grabbed the attention of economists that has led to some defining work in this field. Greif (1994) analyses the relationship between cultural beliefs and the organisation of two trading societies, the Maghribis and the Genoeses. The former being a collectivist one and the latter being an individualistic one. Using a game theoretic framework he shows that the collectivist ones transform in the long run to a society with mostly horizontal relations and one with no legal formal institutional structure whereas the individualist ones have vertical structure with a formal developed legal enforcement system. Guiso, Sapienza and Zingales (2006) provide evidence on the causal effect of culture on economic outcomes via preferences captured by religion and ethnic background which are relatively stable across generations. In order to get to the casual effect, they rule out the possibility of existence of cultural aspects that evolve over time. Doepke and Zilibotti (2008) address this and discuss the emergence of the middle classes as a dominant group during the Industrial Revolution explaining their role in the economy due to the presence of the culture which they call as the spirit of capitalism. In their model they consider the fact that cultural traits can be transmitted from one generation to the other. Specifically they consider a mechanism where parents shape the preferences of their child and inculcate cultural traits like patience and work ethic due to their altruism towards their children. Gorodnichenko and Roland (2016) also discuss the link between culture and economic growth but they incorporate culture not as sets of people differing in their the source of income to begin with as done by Doepke Zilibotti but instead they define what they call as individualist and collectivist cultures. Individualist

societies they define to be the ones that have certain social reward associated with accomplishments like innovation, thereby fostering novelty and creation. The collectivists on the other hand have an upper hand at making collective action and therefore better at coordinating production processes. They argue that for a strong causal effect of individualistic cultures on economic development. Tabellini (2010) analyses the causal effect of culture on economic growth using historical variables as instruments for European countries and finds the cultural factors to be important in determining the current economic progress.

The precise connotation in which we consider culture in our paper is that of motivation or public spirit. There are certain occupations that have a public spirit attached to them. That is, apart from the private gains accruing to the individuals associated with that occupation, there also exist a social benefit that is connected to the public spirited occupation. Examples of these could be doctors who improve the health status of the patients, teachers who develop learning and add to the knowledge, skill or more broadly human capital of the students and scientists who add to the existing stock of knowledge that can be used for greater well being in the economy. Individuals who are motivated to work in these occupations, typically do a better job relative to those who only care about the monetary returns ignoring the 'greater good' that is associated with these occupations. Motivation or public spirit therefore is crucial for these occupations. Besley and Ghatak (2005) describe motivated agents as those who apart from getting tangible or monetary return also get some additional utility from accomplishing tasks that they are motivated towards. They say that motivated agents are "agents who pursue goals because they perceive intrinsic benefits from doing so." Hence we model motivated agents to be those whose utility scales up by a certain factor, in case they join the public spirited occupation and the contribution of these to the society is considered as an increase in future productivity depending upon the relative proportion of these motivated agents in the public spirited occupations.

However, this culture of psychological disposition towards public spirited occupations in economies is not exogenously given. Over time as an economy evolves, so do these psychological traits. These traits being endogenous are passed on from one generation to the other. This transmission of traits can happen either genetically or (and) culturally. We consider a cultural transmission mechanism in our model. There are various channels through which cultural transmission can work. Transmission of cultural traits can happen vertically (from individuals of one generation to other i.e. from parents), in a horizontal manner (among individuals of the same generation) and an oblique manner (from one generation to the other except the parents). Here we consider in a overlapping generations framework, a process of vertical and oblique transmission of traits which is similar to a process given by Bisin and Verdier (2000). In line with Bisin and Verdier, we assume that parents

try to pass on their own trait to their child. They get a warm glow utility if their child has the same psychological disposition as they themselves (paternalist approach). They want to maintain the allegiance of psychological trait in their family and therefore they decide on some time they would take off work and spend with their child to pass on their own trait to him. We here do not consider the fact that parents are altruist towards their child and factor in their future utilities into their own while deciding on the trait to be passed on to the child as done by Dopeke and Zilibotti (2008). The child however also interacts with people from the rest of the population and can pick up the trait from someone else. So parents choice and the proportion of the public spirited agents together determine whether the child ends up being public spirited or not. Note here that parents face an opportunity cost of spending time with their child i.e. they have to forgo the income for that time. As a result of this process the child acquires a certain trait and then in the second period of his life, he decides on what occupation to choose on the basis the market returns and his acquired cultural trait. These two above mentioned sources of interaction between the culture and the market, we show can result in an interesting case where we see that the economy in the long run can be stuck in a low growth trap that is also linked to low levels of inequality. We also show the existence of a trade off in the long run between inequality and economic growth.

2 The Model

We consider a single good, closed economy, populated by overlapping generations of dynasties. Each individual lives exactly for two periods - first period as a child and second period as an adult. Each adult individual has exactly one offspring. The population size of each cohort therefore remains constant, normalised to unity.

Each agent is endowed with one unit of time in both periods. In the first period of his life, as a child, the agent consumes nothing. He also does not take part in any economic activity and spends his entire time interacting and socialising with the adult population (of the parental generation) and acquiring certain cultural traits in the process. In particular, the child picks up some occupation-related cultural traits through this process of socialization. The precise socialisation mechanism through which acquisition of these traits happens is described later (in section 2.4 below).

In the second period of his life, the agent chooses an occupation, depending on his acquired cultural trait and the market returns associated with various occupations. He also decides on the optimal allocation of time between working and interacting with his child, the latter enabling him to influence the cultural traits picked up by the child. Finally, he consumes his entire second period income and dies at the end of the period.

2.1 Mapping Culture to Occupations

There are various occupations available in the economy - each contributing symmetrically to the current production of output. What distinguishes these various occupations is, some of them, in addition, have a public good component attached to them in the sense that they may also contribute to the betterment of the society (current or future). These societal benefits however are not rewarded by the market. Hence these latter occupations have special appeal (beyond their market returns) to the people who are public spirited or 'motivated'.

For simplicity, we consider two occupations - one is public-spirited, the other one is non public-spirited. For want of a better term, we call the first profession 'scientist' (denoted by S) while the second one is called 'manager' (denoted by M).[1]

Adult agents on the other hand are of two types - public-spirited/motivated (type s) and market-oriented/non-motivated (type m). These traits are culturally acquired during childhood.

An individual of either type can potentially choose any occupation. However, if a motivated agent (type s) joins the public spirited occupation (profession S), then apart from receiving the corresponding monetary returns, he also derives some utility by serving the society at large (a la Besley and Ghatak (2005)). We model this extra utility by incorporating a multiplier to the indirect utility derived from joining any occupation. To be more precise, if an agent of type s (who is motivated) joins the public spirited occupation, i.e. becomes a scientist (S), then his utility gets scaled up by a factor q, where $q > 1$.

2.2 Preference

An adult agent's utility function has two components. He derives utility from consumption. The associated utility is captured by the following CRRA utility function:

$$u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}$$

where $0 < \sigma < 1$. For analytic convenience, we assume that $\sigma = \frac{1}{2}$.

Apart from consumption an individual also gets utility if his child acquires the same cultural trait as his own. For instance, for an agent of type s who is highly motivated and public spirited, if his child also becomes public-spirited, then he gets a constant utility $\bar{V}$. Likewise, an agent of type m who is non-motivated and market oriented derives a constant utility $\bar{V}$ if his child is also market-oriented. Agent of either type derives zero utility if

[1] This is just a matter of nomenclature. It is not our intention to imply that managers do not contribute to the society.

the his child turns out to be of a different type. The total expected utility of an adult agent of either type is therefore given by:

$$\begin{aligned} EU_t &= P_t^{ik}\bar{V} + 2c_t^{1/2} \text{ if } k = i, \quad (1) \\ &= 2c_t^{1/2} \text{ if } k \neq i \quad (2) \end{aligned}$$

where i denotes the type of the adult individual and P^{ik} denote the probability that an individual of type i has a child of type k where $k, i \in \{s, m\}$. Note that an individual gets the utility $\bar{V}$ if and only if $i = k$.

2.3 Production Structure

There is a single final good in the economy which can be produced using managerial inputs and inputs from scientists. The technology for producing final good is Cobb Douglas, given as

$$Y_t = 2A_t S_t^{\alpha} M_t^{1-\alpha} \quad (3)$$

where S_t is the aggregate amount of scientific input, M_t is the aggregate input from managers and A_t is the total factor productivity term associated with the production technology. For expositional simplicity, we assume that $\alpha = \frac{1}{2}$ The per unit market return for each factor is given by the respected marginal product, as specified below:

$$w_t^s = A_t \left(\frac{M_t}{S_t}\right)^{\frac{1}{2}}$$

$$w_t^m = A_t \left(\frac{S_t}{M_t}\right)^{\frac{1}{2}}$$

where w_t^s denotes the market return from being a scientist and w_t^m denotes the market return from being a manager. Both w_t^s and w_t^m are endogenously determined in every period by the occupational choice decisions of agents of various types. The occupational choice decisions in turn depends on the (expected) market returns and the type of an agent. We now specify the exact socialization mechanism that determines the type of an adult agent at any time period t.

2.4 Socialisation Mechanism

The socialisation mechanism we adopt here is similar to Bisin and Verdier (2000). A child is born naive - without any specific cultural attribute. During childhood, he picks up a specific cultural type by interacting with the adult population belonging to his parental generation, as well as due to conscious efforts made by his parent to indoctrinate him to the parent's own

cultural values. The outcome of this socialisation process determines his cultural type upon adulthood, which in turn makes him culturally predisposed towards an occupation.

Recall that a parent gets a constant utility $\bar{V}$ from his child being of his own type. He therefore has an incentive to spend some time with his child in order to pass on his own cultural trait towards his child. We should emphasise here that the utility that the parent derives if his child acquires his own type is purely egoistic; it does not depend on the subsequent occupational choice of the child.[2] However, there is cost associated with this transmission process and the cost is purely economic. For the time that he spends with his child, he is not supplying his labour the market and therefore has to forego that part of his wage income. Since wages are related to occupations, this implies that parental occupational choice will indirectly affect the cultural transmission process through the implicit opportunity cost of foregone wage income. A parent optimally decides how much time to spend in socializing his child by doing an appropriate cost-benefit analysis.

If the parent fails to socialise his child towards his own trait, the child picks up the trait from someone else from rest of the adult population whom he ends up interacting with. Let τ_t^{ij} denote the fraction of time chosen by a parent of type i who is engaged in profession j in solialising his child. More is the time a parent spends in socializing his child, more likely it is for the child to be of the same type as the parent. Hence, we use τ_t^{ij} also to denote the probability of successful socialistaion by the parent. However, if this socialisation fails with a probability of $1 - \tau_t^{ij}$,the child interacts with someone else from the population who may be of either type s or type m. So depending upon the proportion of each type in the population, the likelihood of the child interacting with an adult of either type from the rest of the population varies. These two factors together determine the probability of a child being of the same/ different type as his parent.

Let p_t be the proportion of people of type s in the population at time t. Then the probability of a parent of type i has a child of the same type is given as follows

$$P_t^{ss} = \tau^{sj} + \left(1 - \tau^{sj}\right) p_t$$

For a parent who is of type m, this probability is given by:

$$P_t^{mm} = \tau^{mj} + \left(1 - \tau^{mj}\right) (1 - p_t)$$

Finally, the probabilities that parent of type i has a child of a type different from his own are given respectively as follows:

[2]There is enough evidence in evolutionary biology that indicate that people have a natural tendency to replicate their own types quite independent of the associated economic or social benefits.

$$P_t^{sm} = \left(1 - \tau^{sj}\right)(1 - p_t) \text{ - for a pareant of type } s$$

and

$$P_t^{ms} = \left(1 - \tau^{mj}\right) p_t \text{ - for a pareant of type } m.$$

Given these probabilities, the parent optimally chooses his socialization effort so as to maximize his expected utility.

3 Optimal Socialisation Effort

Recall that the utility from consumption is given by the CRRA utility function specified earlier. In absence of any savings or bequest motives, the individual consumes his entire income. However out of his total unit time endowment, he spends τ_t^{ij} with his child and hence is out of the labour market for that fraction of time. The labour supply of the individual is therefore $\left(1 - \tau^{ij}\right)$ for an individual of type i from occupation j. Consequently, he earns a net income $\hat{w}_t^{ij}\left(1 - \tau_t^{ij}\right) w_t^j$, where w_t^j denotes the wage rate in occupation j. Substituting $c_t = \hat{w}_t^{ij}$ into the utility function gives us the following indirect utility from consumption: $\hat{u}\left(\hat{w}_t^j\right) = 2\left(\hat{w}_t^j\right)^{\frac{1}{2}}$.

Substituting this in equation (1)

$$EU^{ij} = P_t^{i,k=i}\bar{V} + \hat{u}\left(\hat{w}_t^{ij}\right) \tag{4}$$

This is the expected utility of an individual of type i who is engaged in some occupation j. For any arbitrary occupational choice of j (which will eventually be determined optimally), an agent maximises this with respect to τ^{ij} and makes the choice of socialisation time. For an agent of type s, the optimal amount of time spent with the child is

$$\tau^{sj} = 1 - \frac{w_t^j}{\left[(1 - p_t)\left(\bar{V}\right)\right]^2} \tag{5}$$

The optimal socialisation time choice for agents of type m is

$$\tau^{mj} = 1 - \frac{w_t^j}{\left[p_t\left(\bar{V}\right)\right]^2} \tag{6}$$

where $j \in \{S, M\}$.

The optimal socialisation efforts by the two types are plotted below as functions of the incomes and respective population sizes of either type. The two lines represent the combination of the proportion of the motivated types and income such that the socialisation time choice is zero. The downward

sloping curve is such a curve for the motivated types and the upward sloping one is for the non motivated types. The time choices as a function of the population p_t are therefore represented in the diagram. In this diagram, for any given p_t we can get the income that makes the socialisation time choice of the individual to be zero. So any income that is greater than that would be high enough to make the parent not spend any time with his child.

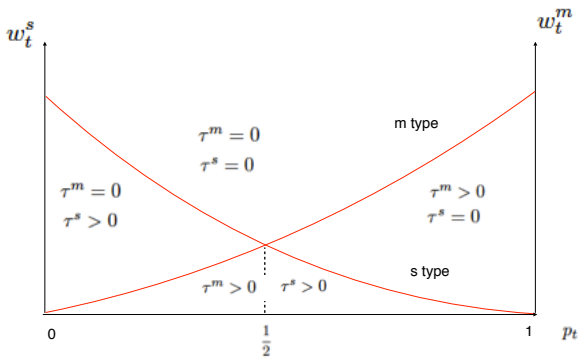

Figure 1: Optimal Socialization Time: Interaction between Income and Population Size

4 Occupational Choice in Equilibrium

Each adult agent in period t decides on his optimal occupation choice, given his type and the wages he expects to earn in either occupation. Recall that the at the beginning of the period, the type of the adult agent is already decided and so is the entire distribution of types (p_t and $1-p_t$)) for economy as a whole. Also recall that there is no market imperfection or fixed investment requirement associated with any profession: anybody can choose any profession and all are equally productive in terms of current output. Hence in choosing one's occupation, one simply has to compare the expected utilities associated with either occupation.

The agents of either type compare their expected utilities from choosing to be a scientist to that from choosing to be a manager. Substituting for the optimal socialisation time choices for any occupation j, we can derive the indirect utilities from each of the occupation for both the types. These are

$$EU_t^{sj} = \bar{V} + \frac{w_t^{sj}}{\bar{V}(1-p_t)} \tag{7}$$

for the type s agents and

$$EU_t^{mj} = \bar{V} + \frac{w_t^{mj}}{\bar{V}p_t} \tag{8}$$

for the type m agents.

Comparing these utilities across occupations for each type, we get the following two equations that determine the optimal occupational choice. An individual of type s will choose to be an scientist if and only if

$$qw_t^S \geq w_t^M. \tag{9}$$

An individual of type m will choose to be an scientist if and only if

$$w_t^S \geq w_t^M. \tag{10}$$

Notice however that w_t^S and w_t^M themselves are endogenously determined in the market by the corresponding marginal products, which in turn depends on the proportional of people (of either type) who join the scientist profession (S_t) vis-a-vis the the managerial job (M_t).

We use λ_t^s to denote the proportion of type s people who choose to be scientists and λ_t^m to denote the proportion of type m people who choose to be scientists. Hence the aggregate labour input from managers, M_t can be written as

$$M_t = (1-\lambda_t^s)\, p_t \left(1-\tau^{sM}\right) + (1-\lambda_t^m)(1-p_t)\left(1-\tau^{mM}\right) \tag{11}$$

The aggregate scientific input is S_t is

$$S_t = \lambda_t^s p_t \left(1-\tau^{sS}\right) + \lambda_t^m (1-p_t)\left(1-\tau^{mS}\right) \tag{12}$$

Substituting the above two equations in equations (8) and (9), we get the two inequalities that describe the individual occupational choices.

The agents of type S who are motivated to be scientists choose to be scientists if and only if the following holds

$$\lambda_t^s \leq \frac{q^2}{1+q^2} + \frac{q^2}{1+q^2}\left(\frac{1-p_t}{p_t}\right)^3 - \lambda_t^m \left(\frac{1-p_t}{p_t}\right)^3 \tag{13}$$

Similarly, the agents who are not motivated to be scientists i.e. those of type M choose to be scientists if and only if

$$\lambda_t^s \leq \frac{1}{2} + \frac{1}{2}\left(\frac{1-p_t}{p_t}\right)^3 - \lambda_t^m \left(\frac{1-p_t}{p_t}\right)^3 \tag{14}$$

We represent these in $(\lambda_t^m, \lambda_t^s)$ space. The figures in the following subsections represents the two lines of equality for different cases depending upon the value of p_t. For values of λ_t^s and λ_t^m below this line, respective agents choose to be scientist and above the line they choose to be managers. The equations (13) and (14) give the occupational choice for the potential set of scientists from the set of the agents of two types i.e. each individual of either type is contemplating whether to choose to be a scientist or to be a manager based on these. Consider an agent of say the non motivated M types. He as an individual is faced with an occupational choice which he decides upon on the basis of (14). If he expects the proportion of people of his type who are choosing to be scientists to be high, then due to the complementary nature of the two set of inputs in the production function, the returns to being a scientist end up actually being high, which makes this individual to choose to be a scientist, giving us a self fulfilling Nash equilibrium.

The equilibrium that we get are of the nature where the agents who are public spirited mostly choose to be scientists while most of those not motivated to be scientists choose to be managers. But the precise proportion of scientists and managers of either type in equilibrium depend on the proportion of the motivated agents in the population at any given point of time. These equilibria for different values of p_t have been described next.

4.1 High values of p_t

For high values p_t[3] we have an equilibrium where all the individuals not motivated to be scientists do not choose to be scientists i.e. they all choose to be mangers and some [4] of the motivated ones also choose to be scientists. This has been represented in figure 1. At this static equilibrium, the wage rate for the scientists is $w_t^S = q^{-1/2} A_t$ and that for the managers is $w_t^M = q^{1/2} A_t$. The wage ratio $\frac{w_t^S}{w_t^M} = \frac{M_t}{S_t} = \frac{1}{q}$ This has been represented in figure 2

4.2 Low values of p_t

For low values [5] of p_t, all the motivated s types choose to be managers and some [6] of those who are non motivated choose to be scientists. This equilibrium has been depicted in figure 3. For these values p_t, the wage rate for scientists is $w_t^S = A_t = w_t^M$ which is the wage rate of the managers. This is the case for income equality. Therefore the wage ratio, $\frac{w_t^S}{w_t^M} = \frac{M_t}{S_t} = 1$

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[3] $p_t \geq \frac{q^{2/3}}{1+q^{2/3}}$

[4] The precise proportion is given by $\hat{\lambda_t^S} = \frac{q^2}{1+q^2}\left(1 + \frac{1-p_t}{p_t}\right)^3$

[5] $p_t \leq \frac{1}{2}$

[6] The proportion of which is given by $\tilde{\lambda}_t^M = \frac{1}{2} - \frac{1}{2}\left(\frac{p_t}{1-p_t}\right)^3$

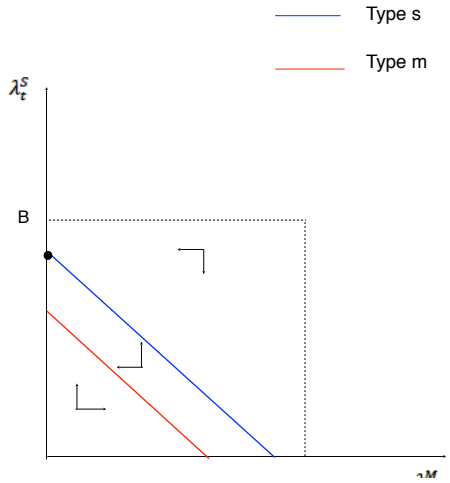

Figure 2: Static Equilibrium for high values of p_t

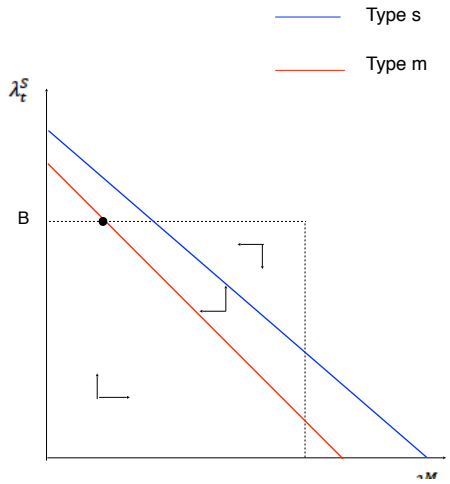

Figure 3: Static Equilibrium for low values of p_t

4.3 Intermediate values of p_t

For intermediate values of the proportion of type s people in the population, we have in equilibrium all the motivated types choose to be scientists and all those who are not public spirited choose to be managers (represented in figure 4) The wage rates for scientists and managers are $w_t^S = A_t \left(\frac{1-p_t}{p_t}\right)^{3/4}$

and $w_t^M = A_t \left(\frac{p_t}{1-p_t}\right)^{3/4}$ respectively. In this case the wage ratio is $\frac{w_t^S}{w_t^M} = \frac{M_t}{S_t} = \left(\frac{1-p_t}{p_t}\right)^{3/2}$

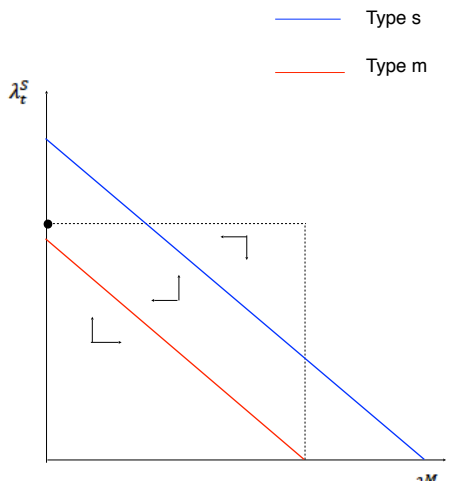

Figure 4: Static Equilibrium for intermediate values of p_t

Summarising the above mentioned cases, we now represent a relationship between the various ranges of p_t that define these cases and the incomes received by agents of each type in equilibrium in each of these cases. The actual incomes in equilibrium of the agents of both the types are represented in the following figure. As p_t changes, so does the equilibrium and the resulting income in that case.

5 Population dynamics

The proportion of the motivated types in the population changes over time depending upon the socialisation time choices of the agents and their incomes. Therefore, the proportion of the s type people in the next time period is given by

$$p_{t+1} = \left(\tau_t^{sj} + \left(1 - \tau_t^{sj}\right)\right) p_t + \left(1 - \tau_t^{mj}\right) p_t \left(1 - p_t\right) \tag{15}$$

where $\tau_t^{sj} = min\left\{1 - \frac{w_t^j}{\left[(1-p_t)\left(\bar{V}\right)\right]^2}, 0\right\}$ and $\tau_t^{mj} = min\left\{1 - \frac{w_t^j}{\left[p_t\left(\bar{V}\right)\right]^2}, 0\right\}$

We have already seen how this optimal socialization effort changes with changes in income levels and population size. Now we have derived the actual income levels of each type for various values of p_t. To analyse the dynamics

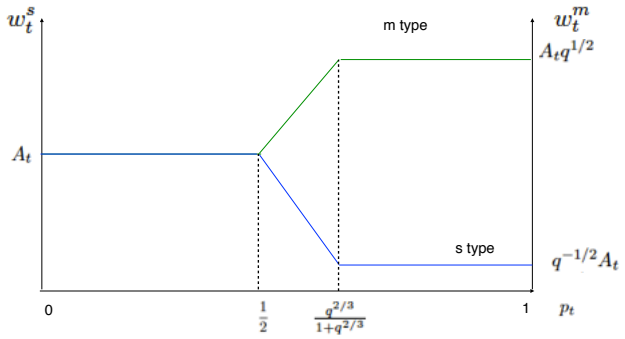

Figure 5: Actual Incomes

of population composition, we superimpose the optimal socialisation time choice lines on the actual income curves. This gives rise to an interesting possibility for a high enough value of q represented in the diagram described next.

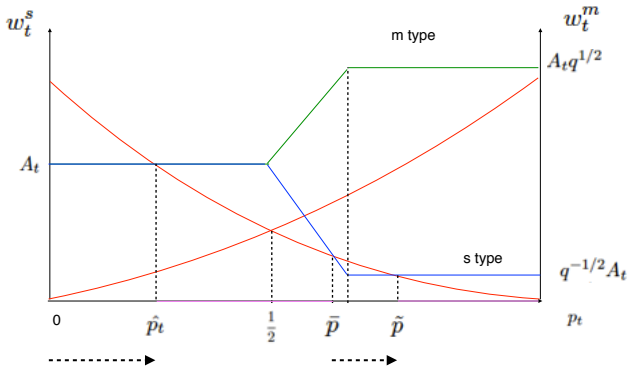

Figure 6: Dynamics

We can rewrite the equation for population dynamics given by (15) as

follows

$$p_{t+1} = p_t + (\tau_t^s - \tau_t^m)\, p_t\, (1 - p_t)$$

So using this dynamic equation and using figure 6 we can see that p_t converges to $\hat{p}$ as well as to $\tilde{p}$. All the values of p lying between $\hat{p}$ and $\bar{p}$ and between $\tilde{p}$ and 1 are the steady states for the population composition of this economy. Here we emphasise on the fact that all the low p_t values between $\hat{p}$ and $\frac{1}{2}$ are steady states along with high values of p_t also being attained as long run steady states This will have an interesting growth implication discussed in the next section.

6 Growth Dynamics Results

The scientists are the ones who contribute to existing stock of knowledge and add to the future productivity, thereby enhancing economic growth. We capture this in our productivity term A_t. We argue that the rate of growth of the productivity parameter depends on the proportion of scientists in the population as a ratio of that of the managers.

$$\frac{A_{t+1} - A_t}{A_t} = g\left(\frac{S_t}{M_t}\right) \qquad where \qquad g' > 0 \tag{16}$$

For the high values of p_t, we know that $\frac{S_t}{M_t} = q$. For intermediate values of p_t, $\frac{S_t}{M_t} = \left(\frac{p_t}{1-p_t}\right)^{3/2}$ and for low values of p_t, the ratio of $\frac{S_t}{M_t} = 1$. The population dynamics point to an interesting case where low levels of p_t i.e. the proportion of the ones with the public spirit in the population can be sustained as a steady state in the long run. Since the low levels of p_t are steady states and the growth rate of output depends on p_t in a positive manner, we end up in a steady state with low growth rate of output. This low growth trap results because of the fact that the proportion of scientists is low in the population. This happens precisely because if we have fewer public spirited agents in the population to begin with, we have fewer scientists and therefore due to the nature of production technology, the earnings from being a scientists are high. This creates a huge time opportunity cost for the parents of the motivated types and they spend lesser effort in socialising their child. This results in fewer public spirited agents in the next generation, thereby resulting in a trap that is associated with fewer motivated agents and low levels of economic growth. We also remark that all these points of equilibrium of p_t at low levels are linked to no income inequality.

At the same time if to begin with we have a high number of motivated agents in the population, greater than $\bar{p}$, then we end up with a case, where we have large proportions of the public spirited agents in the population and also high levels of economic growth. Here also we see that these equilibria at high values of p_t are associated with high inequality as well. Given these

above observations we make the conjecture that high levels of growth are high income inequality in the long run and vice versa. Therefore there exists a trade off between economic growth and income inequality.

Proposition 1. *For high enough values of q, there exists a possibility of the economy ending up in a low growth trap if we begin with a population with fewer agents of type S and if we begin with a population comprising high proportion of type S individuals, we end up in a persistent high growth equilibrium.*

Proposition 2. *Given the condition in proposition 1, there exists a trade off between the income inequality and economic growth.*

Also note that since the rate of growth of the productivity term is positive, the incomes of the individuals of either type goes on increasing. Hence, the curves plotted in figure 4 keeping upon shifting up as we move ahead in time. As this happens, the socialisation time that parents choose, goes to zero. This situation arises because the incomes being high, raises the opportunity cost of spending time with their child for the adult agents. If incomes keep on increasing, they eventually become high enough to make parents spend no time with their child thereby making the cultural transmission process trivial. In this context the population composition doesn't change thereafter and ultimately culture no longer makes any difference in the long run.

Proposition 3. *Culture eventually ceases to matter in the long run.*

7 Conclusion

The bidirectional relation between culture and the economy has been well documented in the literature. Earlier studies have assumed culture to be exogenously determined, until recently some of them have looked at endogenous evolution of culture through various cultural transmission mechanisms. In our paper we consider one of these mechanisms and interact this evolutionary process of culture with the market forces. We have considered a particular aspect of culture i.e public spirit in an overlapping generations framework. Agents with the public spirit if they join related occupations, add to future productivity. As a part of the evolutionary process, we have shown that in the long run, there exists a possibility of the economy getting stuck in a low growth trap that is also associated with low inequality, thereby pointing to a case of a trade off between inequality and growth. However as the economy continues to grow, we show culture eventually doesn't matter for economic growth.

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