Job Reservation and
Intergenerational Transmission of a Work Ethic

Hung-Ju Chen[a] and Rezina Sultana*[b]

[a]*Department of Economics, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, Taipei 10617, Taiwan*

[b]*Department of Economics, Indian Institute of Management Udaipur, MLSU Campus, Udaipur 313001, India*

Abstract

This paper examines the cultural transmission effects of the compensatory-discrimination policies on *work ethic* preference dynamics for the population in a caste-based segregated economy where some high-paid jobs are reserved for the historically disadvantaged low-caste agents as a consequence of the implementation of the policies. Cultural attitudes towards preferences for work-loving and leisure-loving traits evolve endogenously. Changes in the degree of the compensatory-discrimination policies affect differently the preference dynamics for the insider agents (entitled to employment quota) and outsider agents (not entitled to employment quota). The economy can converge to an efficient (inefficient) equilibrium with larger (smaller) fractions of work lovers among the insider and outsider populations. We outline the conditions under which the compensatory-discrimination policy can lead to an efficient equilibrium outcome with sufficiently high level of profit for the principal.

Keywords: Caste system, cultural transmission, work ethic, job reservations, efficiency

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* Corresponding author. Department of Economics, Indian Institute of Management Udaipur, MLSU Campus, Udaipur 313001, India; Tel.: +919610333507; email: rezina.sultana@iimu.ac.in (R. Sultana).

1. Introduction

Affirmative action or compensatory-discriminatory policies have been implemented in the United States, South Africa, Malaysia, Brazil, Nigeria, India, and Sri Lanka with the intent of compensating the present generations of backward groups (across gender, races and castes) for past discrimination and injustice. A large number of studies investigate this policy in various contexts.[1] Studies for example show that the affirmative action have increased women's labor-force participation without compromising efficiency (Balafoutas and Sutter, 2012) and that the policies can have a positive and corrective impact when high-performing women are otherwise impeded from working (Niederle et. al., 2013). It has also been observed that job reservation policies fail to significantly increase employment of historically disadvantaged groups because an employment quota cannot compensate for absence of employment related attributes (Borooah et al., 2007). In this paper, we focus on the efficiency aspect of the policy by addressing the relation between job reservations and cultural transmission of a work ethic.[2] The Indian caste-based job reservation policy is a representative institutional background for our study. The conclusions apply, in principle, more generally.

The Indian Hindu caste system consists of four distinct social classes (called *Varna*) arranged in a hierarchical order according to prestige, economic dominance and educational privileges. In a pre-compensatory discrimination policy regime, people at the bottom of the caste hierarchy (the lower caste group) had denied access to education and "good" jobs.[3] Although the caste system was legislated out of existence in 1951, the introduction of caste-based "reservations" (quotas imposed in the legislature, government-sponsored educational institutions and public sector jobs) by the government of India, which aimed at combatting caste-based inequalities, reinforced caste identities in social and political life (Mendelsohn and Vicziany, 1998).[4]

[1] For an overview of studies on affirmative action in the U.S., see Holzer and Neumark (2000); on Indian caste-based reservations, see Haq and Ojha (2010).

[2] Some studies analyse the incentive and efficiency effects of affirmative action in a framework of job discrimination or wage discrimination relying on the theories of taste-based discrimination (pioneered by Becker, 1957) or statistical discrimination (initially studied by Phelps, 1972; Arrow, 1973). For some theoretical models on affirmative action in this vein, see for example, Welch (1976), Milgrom and Oster (1987), Lundberg (1991), Coate and Loury (1993).

[3] The lower caste group consists of Scheduled Castes and Scheduled Tribes (defined under article 366 of India's Constitution).

[4] Since 1989 the list of beneficiaries of reservation policy has been expanded including the "Other Backward Classes" (OBCs) belonging to different castes and communities, whose position was marginally better than that of the lower-caste group but worse than that of the higher-caste group.

The reservation policy has excluded the private sector. There has been disagreement over extension to the private sector between a section of the political class and the industry leaders (Bhambhri, 2005; Thorat, 2005). Private industry contends that job reservation would compel them to hire less efficient workers for the same wage as more efficient workers. This paper aims at exploring whether the compensatory-discrimination job reservation policy can lead to an efficient equilibrium outcome with sufficiently high level of profit for the employer.

A job-reservation policy is indeed a constraint on employers requiring them to reserve some high-paid jobs with a relaxation in the requirement of effort for the low-caste. With job reservations, workers from different caste groups have an access to equal wages but with different efforts.[5] A wage that fails to account for different levels of effort is perceived as unfair. Perception of unfairness can influence high-caste parents' decisions regarding the socialization effort of transmitting a work ethic to their children.[6]

To describe such intergenerational transmission, we adopt the framework of cultural transmission of preferences of Bisin and Verdier (1998, 2001), which itself builds on population dynamics models of cultural transmission developed in Evolutionary Anthropology and Socio-biology (Cavalli-Sforza-Feldman, 1981; Boyd-Richerson, 1985) and on the work on socialization by Coleman (1994).[7] We set out an overlapping-generations model (OLG) with an infinite-horizon principal-agent relation and rational expectations. In each period, the principal, when matched with the populations of *insiders* (a low-caste group) who are entitled to a reserved quota and *outsiders* (a high-caste group) who do not have an access to such quotas, assigns an employment strategy to the agents of each group. Agents of insider and outsider groups can be of two types of preferences: *work-loving* (having a work ethic) and *leisure-loving* (having no work ethic) and respectively exert high and low effort on work. The principal can allocate agents to the projects with and without the purview of reservation policy. Cultural transmission of a 'work ethic' is defined as the deliberate

[5] Although our model is based on a special feature of Indian caste-based reservation policy, conclusions have broader applicability because affirmative action in the U.S. context portrays similar situation when the employers lower the required standard for the minorities in order to fulfil the affirmative action constraint on them of assigning the workers from different groups to highly rewarded jobs at the same rate.

[6] Experiment conducted by Hoff and Pandey (2006) suggests that the expectations of unfairness on the basis of caste identity undermine the low-caste individuals' motivation to perform well. With compensatory-discrimination policies, fairness concern is however raised by the higher castes.

[7] Explaining the emergence and long run survival of some norms even when the execution of those apparently run counter to individual self-interest has become one of the important issues addressed by cultural transmission models. For an overview of literature on cultural transmission, see Bisin and Verdier (2008). Preferences and norms of behaviour, which are often formed by altruism (Rapoport and Vidal, 2007; Thibault, 2008; Chen, 2009, 2010), cooperation (Bisin et al., 2004) and envy (Teraji, 2007), are transmitted through interactions across and within generations.

inculcation by rational parents who use their own preferences in evaluating ex-ante well-being of their children.

The incentives for insider and outsider parents in shaping preferences of the work ethic of their children depend on economic factors and, hence, directly on the expected payoffs under different strategies of the principal. Whether a principal will adopt a project with the purview of reservation policy is determined by profit under this project. The parents' socialization decision is influenced by perceived utility filtered through their own eyes. Because privileged insider agents who lack a work ethic have a chance of being assigned to high-paid positions under the reservation policy and this disadvantages outsider agents with a work ethic, the perceived utility varies not only across the agents with different work ethic, but also across different groups. Cultural preferences for a work ethic are therefore different among insider and outsider parents; and among parents with different traits.

The rest of the paper is organized as follows. The next section describes the model setting. Section 3 analyses the insider and outsider agents' optimal socialization effort choice, while section 4, discusses the principal's optimal employment strategy. Section 5 presents the preference dynamics for the insiders and outsiders under different policy expectations. In section 6, convergence to the efficient and inefficient equilibria is described and the stability conditions are examined under three possible situations. The final section concludes.

2. The model

Consider an overlapping generations model with two dynasties in the economy – low-caste dynasty and high-caste dynasty, each of which extends over infinite generations $[t = ..., -2, -1, 0, 1, 2, ...]$ discrete time. A compensatory-discrimination reservation policy has been implemented at $t = 0$. In the adverse discrimination regime ($t < 0$) the low-caste agents had denied access to high-paid jobs, whereas in the compensatory-discrimination regime ($t \geq 0$) they have been provided with an employment quota. The low castes who are entitled to employment quota are referred as insiders (*I*) and the high castes without entitlement to quota are referred as outsiders (*O*). Populations of either group remain stationary with $n_{It} + n_{Ot} = 1$, where n_{It} and n_{Ot} are respectively the proportions of insider and outsider agents in the population at period t.[8] Each of the agents belonging to either caste dynasty has a two-period life span. In the first period (childhood) he or she is educated in

[8] The demographic distribution of India reveals that the outsiders are majority in the populations: $n_O > n_I$.

certain type of preferences of *work ethic*, while in the latter period (adulthood) he or she actively participates in the labour market as well as makes an effort attempting to transmit certain type of preferences to his or her only child. The analysis of the cultural transmission of work ethic preferences in this paper is confined to post-compensatory discrimination regime.[9]

2.1. The principal-agent framework

We consider a principal-agent relation where an infinitely-lived principal is matched, at each period, with an insider and an outsider agent at the agents' second period of life. The principal has two projects: a project P_1 without the purview of reservation policy and a project P_2 with the purview of reservation policy. Projects P_1 and P_2 are meant to proxy the private and public sectors respectively. Work under P_1 is more complex and it requires an additional "effort" including work initiative, creativity, managerial competence etc. whereas; work under P_2 is comparatively simpler. The principal decides which project to allocate agents and there is no unemployment.

Under P_1, wage rates are set equal to the effort each agent makes - $\overline{w}_1$ for the high effort ($\overline{e}$) and $\underline{w}_1$ for the low effort ($\underline{e}$), with $\overline{w}_1 > \underline{w}_1$. The principal makes high profits, π_1^h : if the agent exerts a high effort and low profits, π_1^l: if the agent exerts a low effort.

Under P_2, the wage rates $\overline{w}_2$ and $\underline{w}_2$, are offered to the agents who make high and low efforts respectively. Assume that the pay dispersion in the private sector is higher with respect to the public sector, $\Delta w_1 > \Delta w_2$ (where $\Delta w_1 = \overline{w}_1 - \underline{w}_1$ and $\Delta w_2 = \overline{w}_2 - \underline{w}_2$), because the former pays more to attract, retain and motivate the high-effort making agents (see, Lucifora and Meurs 2006). However, with the purview of the reservation policy, an insider who makes a low effort now has a probability, $\alpha \in (0,1)$, of being assigned to a high-paid position.[10] Therefore, the expected wage for an insider agent who makes a low effort is $\alpha \overline{w}_2 + (1-\alpha)\underline{w}_2$. We assume that the chance of having a high-paid position for an insider who makes a low effort is increasing with the proportion of reserved places, say Q; that is,

[9] In the adverse discrimination regime ($t < 0$), jobs were not allocated on the basis of personal comparative advantage. The low-caste agents were compelled to take low-paid jobs and the high-caste agents had an inherited access to high-paid jobs. This fact dilutes the role of cultural transmission of a work ethic.

[10] This assumption reflects the possibility of the high-paid reserved places to be offered, in practice, to the low effort making insiders in dearth of eligible candidates in the insider group.

$\alpha = \alpha(Q)$ with $\alpha'(Q) > 0$. The principal will obtain the profits π_2^h if the agent makes a high effort. If the agent makes a low effort, the profits received by the principal will be π_2^l when the principal pays the low wage rate; and 0 when the principal pays the high wage rate. Therefore, if the agent makes a low effort, the expected profit for the principal will be $(1-\alpha(Q))\pi_2^l$. Profits for the principal are summarized in Table 1.

Table 1: Profits for the principal

P_1		P_2		
			outsiders	insiders
$\bar{e}$	π_1^h	$\bar{e}$	π_2^h	π_2^h
$\underline{e}$	π_1^l	$\underline{e}$	π_2^l	$(1-\alpha(Q))\pi_2^l$

Profit is assumed to be lower under project P_1 compared to project P_2 if agents exert low effort ($\pi_1^l < (1-\alpha(Q))\pi_2^l$), because the low-effort making agents are not able to handle complex work well; whereas the high-effort making agents can contribute more to the profits under P_1 than under P_2 ($\pi_1^h > \pi_2^h$). The order of profits is assumed to be $\pi_1^h > \pi_2^h \geq (1-\alpha(Q))\pi_2^l > \pi_1^l > 0$. Therefore, it is more profitable for the principal to allocate the high-effort making agents to P_1 and the low-effort making agents to P_2.

2.2. Agents' preferences

There are two types of preferences among agents: work-loving (W) and leisure-loving (L).[11] Agents decide to make low or high efforts on work. We assume that there is an additional cost (μ) for a leisure lover to exert a high effort on work. Table 2 gives the payoffs to an insider agent:

Table 2: Payoff matrix for an insider agent

Work lover			Leisure lover		
	P_1	P_2		P_1	P_2
$\bar{e}$	$\bar{w}_1$	$\bar{w}_2$	$\bar{e}$	$\bar{w}_1 - \mu$	$\bar{w}_2 - \mu$
$\underline{e}$	$\underline{w}_1$	$\alpha(Q)\bar{w}_2 + (1-\alpha(Q))\underline{w}_2$	$\underline{e}$	$\underline{w}_1$	$\alpha(Q)\bar{w}_2 + (1-\alpha(Q))\underline{w}_2$

[11] In a framework with endogenous *work ethic* preference, a leisure-lover assigns higher weightage on satisfaction from leisure and lower weightage on satisfaction from work, with respect to a work-lover. Our paper differs from the studies on endogenous labour supply (for example, Cazzavillan and Pintus, 2004).

We also assume that the outsiders making high effort on work suffer from disutility (γ) from working with low effort making insiders in project P_2 since the former need to take extra work but without any additional benefit.[12] This disutility is assumed to increase with Q; that is, $\gamma = \gamma(Q) > 0$ with $\gamma'(Q) > 0$ and $\gamma(0) = 0$. Table 3 gives the payoffs to an outsider agent:

Table 3: Payoff matrix for an outsider agent

Work lover			Leisure lover		
	P_1	P_2		P_1	P_2
$\bar{e}$	$\bar{w}_1$	$\bar{w}_2 - \gamma(Q)$	$\bar{e}$	$\bar{w}_1 - \mu$	$\bar{w}_2 - \mu - \gamma(Q)$
$\underline{e}$	$\underline{w}_1$	$\underline{w}_2$	$\underline{e}$	$\underline{w}_1$	$\underline{w}_2$

Table 2 indicates that high-effort is a dominant strategy for work-loving insiders. However, the work-loving outsiders always prefer exerting high efforts when

$$\gamma(Q) < \Delta w_2 . \tag{1}$$

Furthermore we assume that the cost assigned by the leisure-loving insider and outsider agents to high-effort seeking jobs is high enough so that they always prefer making low efforts. Formally, this implies that

$$\mu > \max\{\Delta w_1, (1-\alpha(Q))\Delta w_2, \Delta w_2 - \gamma(Q)\} \tag{2}$$

To prevent leisure-loving insiders from revealing their trait, assume that leisure-loving insiders prefer to work under project P_1 to P_2. That is

$$[1 - \alpha(Q)]\, \Delta w_2 > \overline{w}_2 - \underline{w}_1$$

When the principal offers P_1, leisure-loving insiders accept it without revealing their types.

2.3. Transmission of preferences

Children are naïve at birth in the sense of having no well-defined preferences before the cultural transmission takes place and depending on parents' exertion of socialization effort (direct vertical socialization) and the peer effect of neighborhood (oblique socialization) they

[12] Insiders who make high efforts will also face the same situation. But being insiders, they have option to choose exerting low efforts but with a chance of getting high wage. Therefore, this disutility for insiders is smaller than that for outsiders. To keep the model as simple as possible this disutility for insiders is assumed to be zero.

adopt a particular preference. A crucial assumption of the model is that parents are altruist towards their children and want to maximize their child's welfare when deciding how much socialization effort to put onto their children. Given that parents are ignorant about the future best outcome for their child, they evaluate their child's future utility through their own payoff matrix.[13]

Let $\tau_k^i \in [0, 1]$ be the socialization effort made by a parent belonging to insider group ($k = I$) or outsider group ($k = O$) with trait $i \in \{W, L\}$. With a success probability equal to the parental effort, τ_k^i, the child adopts his or her parent's preference of trait but with probability $(1 - \tau_k^i)$, the child adopts the preference of the other trait getting matched randomly from the population. Since the children belonging to different castes do not much interact with each other, we assume that they acquire only the trait from the same group. The fractions of the work-loving agents among the insider and outsider populations, at generation t, are respectively denoted by q_{It} and q_{Ot}. The distribution of preferences within a group (q_{kt}, $k = I, O$) is endogenously determined by the socialization decision made by the parents of that group.

Let Z_{kt}^{ij}, $i, j = W, L$, be the probability that a parent of type i belonging to group k has a child adopting a preference of type j. Because there is a continuum of agents, by the Law of Large Numbers, Z_{kt}^{ij} will also denote the fraction of children with a type i parent and becoming a type j person.[14] The mechanism of 'work ethic' preference transmission within a group is then characterized by the following transition probabilities:[15]

$$Z_{kt}^{WW} = \tau_{kt}^{W} + (1 - \tau_{kt}^{W})q_{kt}, \tag{3}$$

$$Z_{kt}^{WL} = (1 - \tau_{kt}^{W})(1 - q_{kt}), \tag{4}$$

$$Z_{kt}^{LL} = \tau_{kt}^{L} + (1 - \tau_{kt}^{L})(1 - q_{kt}), \tag{5}$$

$$Z_{kt}^{LW} = (1 - \tau_{kt}^{L})q_{kt}. \tag{6}$$

[13] This kind of myopic attitude is referred as 'imperfect empathy' by Bisin and Verdier (1998, 2001).

[14] See Al-Najjar (1995) and Sun (1998), for formal constructions of the Law of Large Numbers on the basis of a continuum of agents.

[15] We express the probability of oblique transmission of preferences, for example, work-loving trait within a group, in terms of q_{kt} rather than $q_{kt}n_{kt}$, since we assume a stationary population.

Given these transition probabilities the fraction of agents in the insider or outsider group with work-loving trait at period $t+1$ is given by:

$$q_{k,t+1} = \left[q_{kt} Z_{kt}^{WW} + (1-q_{kt}) Z_{kt}^{LW}\right]. \tag{7}$$

Substituting (3) and (6) into (7),

$$q_{k,t+1} - q_{kt} = q_{kt}(1-q_{kt})\left(\tau_{kt}^{W} - \tau_{kt}^{L}\right), \tag{8}$$

which are the equations in differences that characterize the dynamic of the distribution of preferences among the insider and outsider populations.

3. The agents' socialization effort choice

Socialization of children to a certain type of preference is costly for the parents. Let the cost of direct parental socialization effort take the following quadratic form: $C\left(\tau_{kt}^{i}\right) = \left(\tau_{kt}^{i}\right)^2 / 2\psi$, where $\psi > 0$. Let V_{kt}^{ij} be the utility a parent of type i belonging to group k attributes to his or her child having preferences j . Note that V_{kt}^{ij} depends on the parents' expectations on the strategy of the principal. Assuming perfect foresight, parents of either group know the principal's optimal strategy at period $t+1$, σ_{t+1} .[16]

Given a strategy expectation, parents in group k choose the socialization effort τ_{k}^{i} that maximizes:

$$\left[Z_{kt}^{ii}\left(\tau_{kt}^{i}, q_{kt}\right) V_{k}^{ii}\left(\sigma_{t+1}\right) + Z_{kt}^{ij}\left(\tau_{kt}^{i}, q_{kt}\right) V_{k}^{ij}\left(\sigma_{t+1}\right)\right] - C\left(\tau_{kt}^{i}\right). \tag{9}$$

According to the imperfect empathy notion a parent (of type i) uses his or her own payoff matrix in evaluation of V_{kt}^{ij} . Since the work-loving (leisure-loving) agents prefer exerting high (low) efforts, therefore, $V_{kt}^{ii} > V_{kt}^{ij}$ always.

Maximization of (9) with respect to τ_{k}^{i} yields the first-order condition:

$$\frac{dZ_{k}^{ii}\left(\tau_{kt}^{i}, q_{kt}\right)}{d\tau_{kt}^{i}} V_{k}^{ii}\left(\sigma_{t+1}\right) + \frac{dZ_{k}^{ij}\left(\tau_{kt}^{i}, q_{kt}\right)}{d\tau_{kt}^{i}} V_{k}^{ij}\left(\sigma_{t+1}\right) = \frac{\tau_{kt}^{i}}{\psi}. \tag{10}$$

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[16] In the next section we will see that σ_{t+1} depends on the distribution of preferences in the insider and outsider population, $q_{k,t+1}$. Assuming perfect foresight, equivalent to rational expectation in this deterministic framework, parents' expectation formation at period t on the distribution of preferences in their own group in the next period $t+1$ is: $q_{k,t+1}^{E} = q_{k,t+1}$.

Substituting (3) – (6), we get the optimal effort levels:

$$\hat{\tau}_{kt}^{W}\left(q_{kt}, \sigma_{t+1}\right) = \psi \, \Delta V_{kt}^{W}\left(\sigma_{t+1}\right)\left(1 - q_{kt}\right), \tag{11}$$

$$\hat{\tau}_{kt}^{L}\left(q_{kt}, \sigma_{t+1}\right) = \psi \, \Delta V_{k}^{L}\left(\sigma_{t+1}\right) q_{kt}. \tag{12}$$

Here the difference $\Delta V_{k}^{i}\left(\sigma_{t+1}\right) \equiv V_{k}^{ii}\left(\sigma_{t+1}\right) - V_{k}^{ij}\left(\sigma_{t+1}\right)$ represents the perceived utility gains by a parent transmitting his or her preference to his or her child, given a strategy expectation. In order to guarantee interior solutions $\hat{\tau}_{kt}^{i} \in (0, 1)$ of the socialization problem, we assume that the parameter ψ must be small enough so that $1/\psi > \max \Delta V_{k}^{i}\left(\sigma_{t+1}\right)$.

Let us now analyse how, for a given strategy expectation σ_{t+1}, the optimal socialization effort of parents depends on q_{kt}. Differentiation of (11) and (12) with respect to q_{kt} yields:

$$\frac{d\hat{\tau}_{kt}^{W}\left(q_{kt}, \sigma_{t+1}\right)}{dq_{kt}} = -\psi \, \Delta V_{k}^{W}\left(\sigma_{t+1}\right) < 0, \tag{13}$$

$$\frac{d\hat{\tau}_{kt}^{L}\left(q_{kt}, \sigma_{t+1}\right)}{dq_{kt}} = \psi \, \Delta V_{k}^{L}\left(\sigma_{t+1}\right) > 0. \tag{14}$$

That is, the higher the proportion of work-loving individuals in the insider (outsider) population, the better children are socialized to the work-loving trait by the social environment, inducing the work-loving parents to exert less effort on their children's socialization. Therefore, the work-loving insider (outsider) parents' socialization effort, $\hat{\tau}_{k}^{W}\left(q_{kt}, \sigma_{t+1}\right)$, is decreasing in the fraction of work-loving individuals in their own population, q_{kt}, as revealed by (13).

Symmetrically, leisure-loving insider (outsider) parents' effort, $\hat{\tau}_{k}^{L}\left(q_{kt}, \sigma_{t+1}\right)$, depends negatively on the fraction of leisure-loving trait, $1 - q_{kt}$, hence positively on q_{kt}. That means, the larger the proportion of work-loving preferences in the population, the greater is the effort exerted by the leisure-loving parents in order to offset the pressure of the environment, as they want to transmit their own preferences to their children. Hence for a given strategy expectation, vertical cultural transmission and oblique cultural transmission are substitutes.

4. The principal's optimal strategy

The other determinant of the optimal socialization effort of parents is their expectations about the principals' optimal strategy which we will analyze in this section. At each period t, the infinitely-lived principal has to decide which project is to delegate to the insider and outsider agents with whom he or she is matched. With complete information on the preference-type of agents, the principal would recruit from insider and outsider groups the work-loving agents in P_1 project and leisure-loving agents in P_2 project because $\pi_1^h > \pi_2^h$ and $\pi_2^l > \pi_1^l$. However, the preference of both types of agents in either group is to be assigned to P_1 project and, the principal makes such decisions in an incomplete information framework. Therefore, the principal's aim is to maximize the expected payoffs when he or she knows the proportions of work-loving insiders ($q_I n_I$) and outsiders ($q_O n_O$) in the population but not the type of a particular agent in either group.

The principal has the following two strategies: offering P_1 to everyone within a group σ^f strategy) and offering P_2 to everyone within a group (σ^d strategy). The principal prefers strategy σ^f to σ^d if for the insider group,

$$q_{It} n_I \left(\pi_1^h - \pi_2^h\right) + \left(1 - q_{It}\right) n_I \left[\pi_1^l - (1-\alpha(Q))\pi_2^l\ \right] \geq 0 \,,$$

or equivalently,

$$q_{It} \geq \frac{(1-\alpha(Q))\pi_2^l\ - \pi_1^l}{\pi_1^h - \pi_2^h + (1-\alpha(Q))\pi_2^l\ - \pi_1^l} = \tilde{q}_I(Q)\,, \tag{15}$$

and for the outsider group,

$$q_{Ot} n_O \left(\pi_1^h - \pi_2^h\right) + \left(1 - q_{Ot}\right) n_O \left(\pi_1^l - \pi_2^l\right) \geq 0 \,,$$

or equivalently,

$$q_{Ot} \geq \frac{\pi_2^l - \pi_1^l}{\pi_1^h - \pi_2^h + \pi_2^l - \pi_1^l} = \tilde{q}_O\,. \tag{16}$$

That is, the conditions for adopting the σ^f strategy for the insiders and outsiders are that the fractions of work-loving agents in the insider and outsider populations, at generation t, are higher than the *critical values* $\tilde{q}_I(Q)$ and $\tilde{q}_O$ respectively. Notice that $\tilde{q}_I(Q) < \tilde{q}_O$, since $\alpha(Q) \in (0,1)$. Furthermore, an increase in Q reduces the principal's profits from hiring insiders in project P_2 (the σ^d strategy). Therefore, the principal will switch to the σ^f strategy at a lower value of $\tilde{q}_I(Q)$.

By (15) and (16), the principal's optimal set of strategies can be written as

$$\sigma(q_{It}, q_{Ot}) = \{\sigma(q_{It}), \sigma(q_{Ot})\} = \begin{cases} \{\sigma^d, \sigma^d\} & \text{if } q_{kt} < \tilde{q}_I(Q) \\ \{\sigma^f, \sigma^f\} & \text{if } q_{kt} \geq \tilde{q}_O \\ \{\sigma^d, \sigma^f\} & \text{if } q_{It} < \tilde{q}_I(Q) \text{ and } q_{Ot} \geq \tilde{q}_O \\ \{\sigma^f, \sigma^d\} & \text{if } \tilde{q}_I(Q) \leq q_{kt} < \tilde{q}_O \end{cases}. \tag{17}$$

That means, it is optimal for the principal to choose a *discriminating strategy profile*, σ^D, if the fractions of work-loving agents in the insider and outsider populations are lower than the critical value of the insider group ($q_{kt} < \tilde{q}_I$) and, a *fair strategy profile*, σ^F, if those proportions are higher than the critical value of the outsider group ($q_{kt} \geq \tilde{q}_O$).[17] However, when the fractions of work-loving agents in the insider and outsider populations are such that: $q_{It} < \tilde{q}_I(Q)$ and $q_{Ot} \geq \tilde{q}_O$, then the optimal strategy set consists of the strategies σ^d for the insiders and σ^f for the outsiders. The reverse, $\{\sigma^f, \sigma^d\}$, will be the optimal strategy set if $\tilde{q}_I \leq q_{kt} < \tilde{q}_O$. The last two sets of strategies are referred as *mixed strategy profile,* σ^M.

5. The steady states

In this section we will analyze the pattern of the distribution of preferences in the long run, as characterized by the principal's optimal strategy under the assumption of rational expectations. The dynamics of the distribution of preferences for work-loving trait among the insider and outsider populations are derived by substituting the optimal socialization effort, $\hat{\tau}_k^i(q_{kt}, \sigma_{t+1})$ from (11) and (12) into (8):

$$q_{k,t+1} - q_{kt} = \psi\, q_{kt}(1 - q_{kt})\left[\Delta V_k^W(\sigma_{t+1})(1 - q_{kt}) - \Delta V_k^L(\sigma_{t+1})q_{kt}\right]. \tag{18}$$

[17] The principal's strategy of offering P_2 project to both the insider and outsider agents is referred as *discriminating strategy profile*, σ^D, and offering P_1 to everyone as *fair strategy profile,* σ^F. Under σ^D strategy profile, the insider agents are favored with a provision of reserved quota of high-paid positions which are not allowed to be occupied by workers from the outsider group; whereas under σ^F strategy profile, everyone has an equal access to high-paid positions.

It is useful to know how (18) behaves under a stationary strategy expectation, i.e., if $\Delta V_k^W(\sigma_{t+1}) = \Delta V_k^W(\hat{\sigma})$ and $\Delta V_k^L(\sigma_{t+1}) = \Delta V_k^L(\hat{\sigma})$, where $\sigma_{t+1} = \hat{\sigma}$ for all t. The dynamics (18) has three steady states: (i) $q_k = 0$, (ii) $q_k = 1$ and (iii) $q_k = q_k^* \in (0,1)$, where

$$q_k^* = \frac{\Delta V_k^W(\hat{\sigma})}{\Delta V_k^W(\hat{\sigma}) + \Delta V_k^L(\hat{\sigma})} \tag{19}$$

with $\hat{\tau}_k^W(q_k^*, \hat{\sigma}) = \hat{\tau}_k^L(q_k^*, \hat{\sigma})$.

The degenerate steady states, $q_k = 0$ and $q_k = 1$, are locally unstable. By (13), if work-loving parents within a group k are in a minority (that is, q_{kt} is very close to 0), they produce higher socialization effort in order to offset the counter effect of environment. In this context, $\hat{\tau}_{kt}^W$ exceeds $\hat{\tau}_{kt}^L$ and work-loving preferences tend to expand among next generations preventing their disappearance from the society. Similar argument applies for the distribution of leisure-loving preferences when q_{kt} is very close to 1. The interior rest point $q_k^* \in (0,1)$ characterizing the heterogeneous distribution of preferences is, however, globally stable (as shown later). The process of convergence and the stability of steady state depend on the agents' payoff structure under the principals' different strategy profiles.

We have shown that the exertion of socialization effort by a parent at t depends on his or her expectation about the principal's optimal strategy in the future. As we have shown in (17) that the principal's optimal strategy depends on the distribution of preferences in the populations of insider and outsider agents, we consider the following three possibilities.

<u>Case I</u>: Assume that parents' expectation at period t on the distribution of preferences in the next period $t+1$ is: $q_{k,t+1}^E < \tilde{q}_I(Q)$. Therefore, both the insider and outsider parents expect that the principal will adopt σ^d in the future, $\{\sigma_z\}_{z=t+1}^{\infty} = \{\sigma^D\}_{t+1}^{\infty}$. Then according to the imperfect empathy notion, a parent (of type i) using his or her own utility function evaluates the payoffs of his or her child having preferences j, $V_k^{ij}(\sigma^d)$, as follows:

$$V_I^{WW}(\sigma^d) = \overline{w}_2; \quad V_I^{WL}(\sigma^d) = V_I^{LL}(\sigma^d) = \alpha(Q)\overline{w}_2 + (1-\alpha(Q))\underline{w}_2; \quad V_I^{LW}(\sigma^d) = \overline{w}_2 - \mu;$$

$$V_O^{WW}(\sigma^d) = \overline{w}_2 - \gamma(Q); \quad V_O^{WL}(\sigma^d) = V_O^{LL}(\sigma^d) = \underline{w}_2; \quad V_O^{LW}(\sigma^d) = \overline{w}_2 - \mu - \gamma(Q).$$

Therefore, the relative gains for insider and outsider parents of transmitting own preferences to their child are given by

$$\Delta V_I^W\left(\sigma^d\right) \equiv V_I^{WW}\left(\sigma^d\right) - V_I^{WL}\left(\sigma^d\right) = (1-\alpha(Q))\Delta w_2;$$

$$\Delta V_I^L\left(\sigma^d\right) \equiv V_I^{LL}\left(\sigma^d\right) - V_I^{LW}\left(\sigma^d\right) = \mu - (1-\alpha(Q))\Delta w_2;$$

$$\Delta V_O^W\left(\sigma^d\right) = \Delta w_2 - \gamma(Q);$$

$$\Delta V_O^L\left(\sigma^d\right) = \mu + \gamma(Q) - \Delta w_2.$$

The following proposition demonstrates the possible effect of the quantum of reservation on an endogenous choice of socialization effort by two types of parents in the insider and outsider groups.

PROPOSITION 1: *Under* σ^D strategy *profile,* $\hat{\tau}_k^W\left(q_{kt}, \{\sigma^D\}_{t+1}^{\infty}\right)$ *is decreasing and* $\hat{\tau}_k^L\left(q_{kt}, \{\sigma^D\}_{t+1}^{\infty}\right)$ *is increasing in* Q.

Proof: See Appendix A.

Proposition 1 demonstrates that an increase in the quantum of reservation undermines the motivation of the work-loving parents of either group to transmit their trait into their offspring. This occurs because a rise in the proportion of reserved position enhances the chance of receiving higher wage for insiders who make low efforts, as well as, increases the disutility for outsiders making high efforts but working with lower effort making insiders. By similar argument, the leisure-loving parents will have higher incentive to make their children like them.

<u>Case II</u>: If $q_{k,t+1}^E \geq \tilde{q}_O$, both the insider and outsider parents expect that the principal will adopt σ^f in the future, i.e., $\{\sigma_z\}_{z=t+1}^{\infty} = \{\sigma^F\}_{t+1}^{\infty}$. Parents' expected payoffs of their children are:

$$V_k^{WW}\left(\sigma^f\right) = \overline{w}_1; \qquad V_k^{WL}\left(\sigma^f\right) = V_k^{LL}\left(\sigma^f\right) = \underline{w}_1; \qquad V_k^{LW}\left(\sigma^f\right) = \overline{w}_1 - \mu.$$

Therefore, the perceived net utility gains for insider and outsider parents of transmitting their own preferences are given by

$$\Delta V_k^W\left(\sigma^f\right) = \Delta w_1; \qquad \Delta V_k^L\left(\sigma^f\right) = \mu - \Delta w_1;$$

Note that with the expectation of the σ^f strategy in the future, the socialization efforts exerted by the two types of parents among the insiders and outsiders are unaffected by Q.

<u>Case III</u>: If $q_{I,t+1}^E < \tilde{q}_I(Q)$ and $q_{O,t+1}^E \geq \tilde{q}_O$, the insider parents expect that the principal will offer P_2 project but the outsider parents expect to get P_1 project. The expectations will be reverse when $\tilde{q}_I(Q) \leq q_{k,t+1}^E < \tilde{q}_O$.[18] However, because the parents' exertion of socialization effort depends on the distribution of preferences in their own group, they will not compare the distribution of preferences in their own group with that of the other group while forming expectation about the principal's optimal strategy. Moreover, the principal decides on optimal strategy looking at the distribution of preferences in the two groups separately. Therefore, with an expectation of mixed strategy profile in the future, $\{\sigma_z\}_{z=t+1}^{\infty} = \{\sigma^M\}_{t+1}^{\infty}$, an insider and an outsider parent evaluate the payoffs of his or her child $V_I^{ij}(\sigma^d)$ and $V_O^{ij}(\sigma^f)$ if $q_{I,t+1}^E < \tilde{q}_I(Q)$ and $q_{O,t+1}^E \geq \tilde{q}_O$. The reverse is true if $\tilde{q}_I(Q) \leq q_{k,t+1}^E < \tilde{q}_O$.

Using (18) we can now derive the preference dynamics for both the insider and outsider groups in the above three possibilities under the perfect foresight assumption, i.e., when $q_{k,t+1}^E = q_{k,t+1}$. If $q_{k,t+1} < \tilde{q}_I(Q)$, the principal offers P_2 project to everyone. Then we have:

$$q_{I,t+1} = q_{It}\left[1 + \psi\left(1 - q_{It}\right)\{(1-\alpha(Q))\Delta w_2 - \mu q\}\right]; \tag{A}$$

$$q_{O,t+1} = q_{Ot}\left[1 + \psi\left(1 - q_{Ot}\right)\left(\Delta w_2 - \gamma(Q) - \mu q_{Ot}\right)\right]; \tag{B}$$

If $q_{k,t+1} \geq \tilde{q}_O$, the principal offers P_1 project to everyone. Then we have:

$$q_{k,t+1} = q_{kt}\left[1 + \psi\left(1 - q_{kt}\right)\left(\Delta w_1 - \mu q_{kt}\right)\right], \quad k = I, O. \tag{C}$$

If $q_{I,t+1} < \tilde{q}_I(Q)$ and $q_{O,t+1} \geq \tilde{q}_O$, the principal offers P_2 project to insiders and P_1 project to outsiders. This implies that the preference dynamics for the insider agents is given

[18] In these two situations, when the principal adopts different strategies for the insiders and outsiders then the compensatory-discrimination reservation policy in project P_2 will no longer exist and, $\tilde{q}_I = \tilde{q}_O$. This is because when the high-caste agents are not given project P_2, there is no need for reservation for the low-caste persons in that project. Conversely, when the low-caste agents are not given project P_2, in reality no low-caste lower effort making person can get a high-paid job and thereby removing the disutility for high-caste high-effort making agent. Therefore the principal's optimal strategy of offering project P_2 to an insider or an outsider amounts to offering a low remunerative project without reservation, which will happen respectively when $q_{It} \leq q_{Ot}$ and $q_{It} > q_{Ot}$, given that $n_O > n_I$.

by (A) and that for the outsider agents is given by (C). Conversely, if $\tilde{q}_I(Q) \leq q_{k,t+1} < \tilde{q}_O$, the principal offers P_2 project to outsiders and P_1 project to insiders, thereby implying the preference dynamics (B) for the outsiders and (C) for the insiders. Notice that there are discontinuities in $q_{I,t+1} = \tilde{q}_I(Q)$ and $q_{O,t+1} = \tilde{q}_O$. The dynamics (A), (B) and (C) will alternatively be denoted as $F_A(\cdot)$, $F_B(\cdot)$ and $F_C(\cdot)$ respectively.

Let $\underline{q}_I(Q) = q_I^*(\sigma^d) = \frac{(1-\alpha(Q))\Delta w_2}{\mu}$, $\underline{q}_O(Q) = q_O^*(\sigma^d) = \frac{\Delta w_2 - \gamma(Q)}{\mu}$ and $\bar{q} = q_k^*(\sigma^f) = \frac{\Delta w_1}{\mu}$ denote respectively the stable steady states characterizing the heterogeneous preference of $F_A(\cdot)$, $F_B(\cdot)$ and $F_C(\cdot)$. As shown in Appendix C, there are three steady states of each dynamics (A), (B) and (C), where 0 and 1 are unstable steady states and q_k^* ($\underline{q}_I$, $\underline{q}_O$ and $\bar{q}$) is a stable steady state.

Notice that $\underline{q}_I(Q) < \underline{q}_O(Q)$, with $\gamma(Q) < \alpha(Q)\Delta w_2$.[19] Furthermore, the three stable steady states can be ordered as $\underline{q}_I(Q) < \underline{q}_O(Q) < \bar{q}$, given that $\Delta w_1 > \Delta w_2$. Then $(\bar{q}, \bar{q})$ is referred as an efficient steady state characterized by larger proportions of work-loving insider and outsider agents, and the low-caste agents do not have an access to the reserved quota with the principal adopting the fair strategy profile; whereas $(\underline{q}_I, \underline{q}_O)$ as an inefficient steady state with the respective proportions lower and the low-caste agents benefit from the implementation of the reservation policy.

LEMMA 1: *Comparing the socialization efforts exerted by the two types of parents, we have:*

1. $\tau_k^W\left(q_{kt}, \{\sigma^F\}_{t+1}^{\infty}\right) \gtreqless \tau_k^L\left(q_{kt}, \{\sigma^F\}_{t+1}^{\infty}\right)$ *when* $q_{kt} \lesseqgtr \bar{q}$;

2. $\tau_k^W\left(q_{kt}, \{\sigma^D\}_{t+1}^{\infty}\right) \gtreqless \tau_k^L\left(q_{kt}, \{\sigma^D\}_{t+1}^{\infty}\right)$ *when* $q_{kt} \lesseqgtr \underline{q}_k$.

Proof: See Appendix B.

[19] We assume that the upper bound to disutility perceived by an outsider agent is $\alpha(Q)\Delta w_2$.

6. Dynamics

Note that $\tilde{q}_O$ and $\bar{q}$ are independent of the quantum of reservation (Q), whereas $\tilde{q}_I(Q)$, $\underline{q}_I(Q)$ and $\underline{q}_O(Q)$ decrease with an increase in Q. The order of the critical values is $\tilde{q}_I(Q) < \tilde{q}_O$, whereas the order of the steady states is $\underline{q}_I(Q) < \underline{q}_O(Q) < \bar{q}$. Depending on the values of parameters and the level of quantum of reservation, three possible situations arise for both the insiders and outsiders: (1) $\tilde{q}_k < \underline{q}_k < \bar{q}$; (2) $\underline{q}_k < \bar{q} < \tilde{q}_k$; and (3) $\underline{q}_k < \tilde{q}_k < \bar{q}$, $k = I, O$, Under these three situations the economy will have different long-run performances as discussed in the following three sub-sections.

6.1. $\tilde{q}_k < \underline{q}_k < \bar{q}$

We start our analysis by considering the situation of low threshold values ($\tilde{q}_k < \underline{q}_k < \bar{q}$). The low values of $\tilde{q}_I$ and $\tilde{q}_O$ can be results of low profits for the principal in project P_2 (π_2^l or π_2^h) or high profits in project P_1 (π_1^l or π_1^h). Especially, we assume that the level of reserved jobs is low enough, such that, $\alpha(Q) < 1 - \frac{\mu}{\Delta w}\left(\frac{\pi_2^l - \pi_1^l}{\pi_1^h - \pi_2^h + \pi_2^l - \pi_1^l}\right)$, thereby leading to a situation of $\tilde{q}_O < \underline{q}_I$. This gives the order of threshold values and steady states as $\tilde{q}_I < \tilde{q}_O < \underline{q}_I < \underline{q}_O < \bar{q}$.

PROPOSITION 2: *The economy will converge to the efficient equilibrium outcome,* $(\bar{q}, \bar{q})$, *if* $\tilde{q}_k < \underline{q}_k$.

Proof: See Appendix C.

The phase diagram in Figure 1 describes the intergenerational evolution of preferences in the insider and outsider populations and convergence of the distribution of preferences to the efficient steady state, $(\bar{q}, \bar{q})$, when $\tilde{q}_O < \underline{q}_I$. In Figure 1, q'_A is the value that yields $q_{I,t+1} = \tilde{q}_I$ with dynamics (A) and q'_{C_1} is the value that yields $q_{I,t+1} = \tilde{q}_I$ with dynamics (C) (namely $F_A(q'_A) = \tilde{q}_I$ and $F_C(q'_{C_1}) = \tilde{q}_I$). Similarly, q'_B and q'_{C_2} are the values that yield

$q_{O,t+1} = \widetilde{q}_O$ with dynamics (B) and (C) respectively (namely $F_B(q'_B) = \widetilde{q}_O$ and $F_C(q'_{C_2}) = \widetilde{q}_O$). For any particular value of the parameters, $q'_A > q'_{C_1}$ and $q'_B > q'_{C_2}$ always.

Assume initially, most insider (outsider) agents have leisure-loving preferences (that is, q_{I0} (q_{O0}) close to 0). The insider (outsider) parents expect the σ^d strategy for the next generation. Nevertheless, as parents try to transmit their own preferences and the work-loving parents within a group k are in a minority, the socialization efforts of this type of parents are high in order to offset the counter effect of environment on their children. The opposite applies for the leisure-loving parents because oblique transmission is a substitute of vertical transmission. This results in an expansion of work-loving preferences over next generations among the group k population.

<Figure 1 is inserted about here>

It follows from inspection of the above figure that from any $q_{I0} \in (0, q'_{C_1})$ and $q_{O0} \in (0, q'_{C_2})$, a unique q_{It} path starts following dynamics (A) and a unique q_{Ot} path starts following dynamics (B). With a low threshold level for switching to implement the σ^f strategy, the expansion of work-loving agents among insider and outsider populations leads to a situation such that q_{It} and q_{Ot} reach the intervals $[q'_{C_1}, q'_A]$ and $[q'_{C_2}, q'_B]$ respectively, when both σ^d and σ^f strategies are possible. If the agents expect the σ^d strategy, then the dynamics (A) and the dynamics (B) will be followed and q_{It} and q_{Ot} will increase over time. Once when q_{It} and q_{Ot} are respectively higher than q'_A and q'_B then the agents expect that only σ^f strategy will be adopted. The shift in expectation from a σ^d strategy to a σ^f strategy removes leisure-loving insider agents' chance of having high wage rates when making low efforts and resolves work-loving outsider agents' disutility, thereby leading both q_{It} and q_{Ot} to follow dynamics (C). Consequently, both the insider and outsider agents' preferences for work-loving trait converge to the efficient steady state ($\overline{q}, \overline{q}$) with high proportions of work-loving insider and outsider agents.

The convergence to the efficient steady state ($\overline{q}, \overline{q}$) is also achieved from any other initial condition. If $q_{I0} \in (q'_A, 1)$ and $q_{O0} \in (q'_B, 1)$, there is a unique and the same q_{kt} path for both insiders and outsiders, following dynamics (C), results with q_{kt} converging to $\overline{q}$. Therefore, we have the following proposition.

6.2. $\underline{q}_k < \bar{q} < \tilde{q}_k$

We now turn to consider the situation of high threshold values ($\underline{q}_k < \bar{q} < \tilde{q}_k$). The high values of $\tilde{q}_I$ and $\tilde{q}_O$ can be caused by high profits in project P_2 (π_2^l or π_2^h) or low profits in project P_1 (π_1^l or π_1^h). Especially, we assume that the quantum of reserved positions is low enough, such that, $\alpha(Q) < 1 - \frac{1}{\pi_2^l}\left[\pi_1^l + \frac{(\pi_1^h - \pi_2^h)\Delta w_1}{\mu - \Delta w_1}\right]$, thereby leading to a situation of $\bar{q} < \tilde{q}_I$. This gives the order of threshold values and steady states as $\underline{q}_I < \underline{q}_O < \bar{q} < \tilde{q}_I < \tilde{q}_O$.

PROPOSITION 3: *The economy will converge to the inefficient steady state, ($\underline{q}_I$, $\underline{q}_O$), if $\bar{q} < \tilde{q}_k$.*

Proof: See Appendix D.

The phase diagram in Figure 2 describes the process of convergence of the distribution of preferences in the insider and outsider populations to the inefficient steady states ($\underline{q}_I$, $\underline{q}_O$). The values q'_A, q'_{C_1}, q'_B and q'_{C_2} are defined as before.

<Figure 2 is inserted about here>

Begin with an initial situation where most insider (outsiders) agents have leisure-loving preferences (that is, q_{O0} (q_{O0}) close to 0). Initially and similarly to the previous case, the work-loving parents in either group have more incentives than the leisure-loving parents to intensify their socialization effort ($\hat{\tau}_{kt}^W > \hat{\tau}_{kt}^L$), leading to increases in q_{It} and q_{Ot}. With the increase in q_{kt}, the difference in efforts between the work-loving and leisure-loving parents diminishes. Before reaching the threshold level for the adoption of the σ^f strategy by the principal, the socialization efforts of both types of insider and outsider parents under the σ^d strategy are equalized, and the economy is trapped in the steady state ($\underline{q}_I$, $\underline{q}_O$), with a relatively high proportion of leisure-loving insider and outsider agents.

Notice that the rise in the proportion of work-loving agents among outsiders, q_{Ot}, is relatively faster than that among insiders, q_{It} (dynamics (B) lies above dynamics (A)), because of two opposite effects on socialization efforts under the anticipation of σ^d strategy. The first one is that the perceived utility gained by the high effort making outsider parents is relatively lower than that by the insider parents as the former also perceive utility loss due to the possibility of working with low effort making insiders. The second effect is that, with an anticipation of σ^d strategy the leisure-loving insider parents exert higher effort to transmit their trait to their children. However, with a lower extent of disutility, such that, $\gamma(Q) < \alpha(Q)\Delta w_2$, the second effect will dominate the first effect, thereby inducing the steady state $\underline{q}_I$ to reach earlier than $\underline{q}_O$.

The convergence to the inefficient steady states ($\underline{q}_I$, $\underline{q}_O$) are attained from any initial situation. Even a large proportion of work-loving agents in the population to begin with would lead the economy to end up with the inefficient steady state in the long run, because then leisure-loving parents take relatively higher initiative than the work-loving parents to transmit their own preferences to their children ($\hat{\tau}_{kt}^L > \hat{\tau}_{kt}^W$) despite the σ^f strategy taken by the principal, thereby leading to a decrease in q_{kt}. When the contraction of work-loving agents among insider and outsider populations lead to a situation such that q_{It} and q_{Ot} reach the intervals $[q'_{C_1}, q'_A]$ and $[q'_{C_2}, q'_B]$ respectively, then the possible strategies are both σ^f and σ^d. If the agents switch their expectation from the σ^f strategy to the σ^d strategy, it forms the expectation of getting a high wage rate for the low effort making insiders and a high level of disutility for outsiders who exert high efforts. The combined effect of cultural substitution and a switch in principal's strategy leads to a situation such that $q_{I,t+1} < \tilde{q}_I$ and $q_{O,t+1} < \tilde{q}_O$, which self-confirms the insider and outsider agents' expectations. Consequently, a dynamics is generated that moves the economy towards the inefficient steady state ($\underline{q}_I$, $\underline{q}_O$).

6.3 $\underline{q}_k < \tilde{q}_k < \bar{q}$

Finally, we consider the situation where the threshold values are in between the inefficient and efficient equilibria ($\underline{q}_k < \tilde{q}_k < \bar{q}$). Especially, we assume the order of threshold values and steady states as follows: $\underline{q}_I < \underline{q}_O < \tilde{q}_I < \tilde{q}_O < \bar{q}$. Notice that there is no indeterminacy in the steady state distribution of preferences because the parents' socialization efforts are adjusted to make their expectations self-confirmed.

The convergence of preferences to the efficient equilibrium, $(\overline{q}, \overline{q})$ or to the inefficient equilibrium, $(\underline{q}_I, \underline{q}_O)$ is summarized in the next proposition.

PROPOSITION 4: *If* $\underline{q}_k < \tilde{q}_k < \overline{q}$, *then*

(i) for all $q_{I0} \in [q'_{C_1}, q'_A]$, $q_{O0} \in \lfloor q'_{C_2}, q'_B \rfloor$, *there are two perfect foresight paths, both for insiders and outsiders, converging to* $(\underline{q}_I, \underline{q}_O)$ *and* $(\overline{q}, \overline{q})$ *respectively.*

(ii) for all $q_{I0} \in (0, q'_{C_1})$, $q_{O0} \in (0, q'_{C2})$, *there is convergence to* $(\underline{q}_I, \underline{q}_O)$ *if* $\underline{q}_I < q'_{C_1}$, $\underline{q}_O < q'_{C_2}$ *and; there are two perfect foresight paths converging to* $(\underline{q}_I, \underline{q}_O)$ *and* $(\overline{q}, \overline{q})$ *respectively if* $\underline{q}_I > q'_{C_1}$, $\underline{q}_O > q'_{C_2}$.

(iii) for all $q_{I0} \in (q'_A, 1)$, $q_{O0} \in (q'_B, 1)$, *there is convergence to* $(\overline{q}, \overline{q})$ *if* $q'_A < \overline{q}$, $q'_B < \overline{q}$ *and; there are two perfect foresight paths converging to* $(\underline{q}_I, \underline{q}_O)$ *and* $(\overline{q}, \overline{q})$ *respectively if* $q'_A > \overline{q}$, $q'_B > \overline{q}$.

Proof: See Appendix E.

Let us start with a condition when $q_{I0} \in [q'_{C_1}, q'_A]$ and $q_{O0} \in [q'_{C_2}, q'_B]$, the path of the distribution of preferences may lead to a convergence to the efficient equilibrium $(\overline{q}, \overline{q})$ or the inefficient equilibrium $(\underline{q}_I, \underline{q}_O)$, depending on the insider and outsider parents' expectation about the principal's future strategies.

<Figure 3 is inserted about here>

When the initial state is $q_{I0} \in (0, q'_{C_1})$ and $q_{O0} \in (0, q'_{C2})$, the insider and outsider parents believe that the today's σ^d strategy will be followed by the principal in the future and, if $\underline{q}_I < q'_{C_1}$ and $\underline{q}_O < q'_{C_2}$, then the economy will get trapped in the inefficient equilibrium, $(\underline{q}_I, \underline{q}_O)$. However, if $\underline{q}_I > q'_{C_1}$ and $\underline{q}_O > q'_{C_2}$, the insider and outsider parents may expect a switch in the principal's strategy for the next generations once when $q_{It} \in [q'_{C_1}, q'_A]$ and $q_{Ot} \in [q'_{C_2}, q'_B]$. Then there will be two paths converging to the inefficient and efficient equilibria respectively.

On the other hand, when the initial state is $q_{I0} \in (q'_A, 1)$ and $q_{O0} \in (q'_B, 1)$, the insider and outsider parents will expect a σ^f strategy adopted in the future if $q'_A < \bar{q}$ and $q'_B < \bar{q}$, the economy will converge to the efficient equilibrium. However, if $q'_A > \bar{q}$ and $q'_B > \bar{q}$, the insider and outsider parents may expect a switch in the principal's strategy for the next generations once when $q_{It} \in [q'_{C_1}, q'_A]$ and $q_{Ot} \in [q'_{C_2}, q'_B]$. Under this situation, there will be two paths converging to the inefficient and efficient equilibria respectively.

6.4 Effects of the reservation policy

We shall now discuss how the reservation policy impacts on the preference dynamics of insider and outsider population under different circumstances. First note that $\tilde{q}_O$ and $\bar{q}$ are independent of the quantum of reserved jobs. Therefore, changes in the degree of reservation policy will affect the 'work ethic' preference dynamics of outsiders by affecting the value of $\underline{q}_O$. If the parameter values indicate that the threshold value for outsiders is sufficiently high, such that $\bar{q} < \tilde{q}_O$, then as discussed in Section 6.2, the 'work ethic' preference dynamics of outsiders will converge to the inefficient equilibrium, regardless of the quantum of reserved positions.

However, if the parameter values define a lower threshold level for outsiders, such that $\tilde{q}_O < \bar{q}$, then the degree of reservation policy will affect the long-run distribution of preferences of outsiders. Note that a decrease in the level of reserved jobs increases $\underline{q}_O$. So, if the decrease in the level of reserved jobs is large enough to turn the case of $\underline{q}_O < \tilde{q}_O$ (see Section 6.2) into the case of $\tilde{q}_O < \underline{q}_O$ (see Section 6.1), then reducing the quantum of reservation is one way to push the dynamics of outsiders to converge to the efficient equilibrium. This is because a reduction in the level of reserved jobs lowers the disutility of outsiders who make high efforts in project with job reservation. With a lower level of reserved jobs, work-loving outsider parents will be inclined towards transmitting their trait to their children when expecting the principal to adopt the σ^d strategy, thereby leading to a higher steady state of $\underline{q}_O$.[20] With a sufficiently high $\underline{q}_O$, the principal will switch to adopt the σ^f strategy before q_{ot} reaches $\underline{q}_O$, thereby leading q_{ot} to converge to the efficient

[20] Note that the level of reserved jobs does not affect the *work ethic* preference dynamics of outsiders, if $\gamma = 0$.

equilibrium. However, with the principal adopting the σ^f strategy in the long run the possibility of the low-caste agents benefitting from the reservation policy is also discarded.

In case of insiders, the analysis of how the reservation policy impacts on their long-run distribution of preferences is more complicated since changes in Q will affect both $\tilde{q}_I$ and $\underline{q}_I$. Note that a lower level of Q increases the principal's profits of hiring insiders in project P_2, which in turn raises the threshold value $\tilde{q}_I$ for adopting the σ^f strategy for insiders. Moreover, for leisure-loving insider parents, a lower level of Q reduces the incentive to transmit their trait to their children, inducing thereby a higher value of $\underline{q}_I$. If initially, the level of Q is so low that the threshold value is higher than the efficient steady state ($\bar{q} < \tilde{q}_I$), then a sufficiently large increase in Q leads to a situation such that the threshold value is lower than the efficient steady state ($\tilde{q}_I < \bar{q}$), which may prevent q_{It} from being trapped into the inefficient equilibrium. However, this increase in the level of reserved jobs cannot guarantee the convergence of q_{It} to the efficient equilibrium since both $\tilde{q}_I$ and $\underline{q}_I$ decrease with an increase in Q.

The above discussion is based on the ordering of three stable steady states as $\underline{q}_I(Q) < \underline{q}_O(Q) < \bar{q}$, given that $\Delta w_1 > \Delta w_2$ and $\gamma < \alpha\,\Delta w_2$. Accordingly, $\left(\bar{q}, \bar{q}\right) \quad \left(\underline{q}_I, \underline{q}_O\right)$. However, with $\Delta w_1 \le \Delta w_2$, the σ^D strategy profile becomes outcome efficient, $\left(\underline{q}_I, \underline{q}_O\right) \quad \left(\bar{q}, \bar{q}\right)$, if $\begin{cases} \alpha < \left(1 - \dfrac{\Delta w_1}{\Delta w_2}\right) \\ \gamma \le \left(\Delta w_2 - \Delta w_1\right) \end{cases}$; otherwise σ^D is outcome inefficient. This shows that even with a discriminating strategy profile adopted by the principal the economy can converge to an efficient equilibrium outcome, $\left(\underline{q}_I, \underline{q}_O\right)$, where the proportions of work-loving insider and outsider agents are higher than that with the fair strategy profile. This is because with a sufficiently large wage differential between high-effort making and low-effort making agents in project P_2 the work-loving agents will be motivated and the leisure-loving agent will have less incentive to transmit their trait to their children. In this case, the three steady states can be ordered as $\bar{q} < \underline{q}_I(Q) < \underline{q}_O(Q)$. Then the three possible situations to be faced by the insiders and outsiders are: (1) $\tilde{q}_k < \bar{q} < \underline{q}_k$, when $\tilde{q}_O < \bar{q}$; (2) $\bar{q} < \underline{q}_k < \tilde{q}_k$, when $\underline{q}_O < \tilde{q}_I$; and (3) $\bar{q} < \tilde{q}_k < \underline{q}_k$, when $\bar{q} < \tilde{q}_I < \tilde{q}_O < \underline{q}_I < \underline{q}_O$. Notice that the process of convergence to the steady states will remain the same but the outcome will change qualitatively. That means, with a high threshold value resulting from higher (lower) level of profits in project P_2 (project P_1), the economy will converge to the efficient equilibrium outcome with compensatory discrimination policy, $\left(\underline{q}_I , \underline{q}_O\right)$, and vice-versa.

7. Conclusions

This paper proposes a dynamic model of *work ethic* preference formation and examines the effects of the compensatory-discrimination policy. The cultural attitude towards *work ethics* evolves endogenously and leads to a heterogeneous distribution of preferences, since both the work-loving and leisure-loving insider and outsider agents choose positive socialization efforts in order to prevent disappearance of their trait from their population. We show that the lower the proportion of a given preference type in the population, the higher is the parental socialization effort and vice-versa.

Besides being theoretically more satisfactory than a model with exogenous *work ethic* preference, our model analyzes the long-run efficiency outcome of affirmative action. There are two stable equilibria: an efficient equilibrium characterized by larger fractions of work-loving insiders and outsiders and an inefficient equilibrium with the respective fractions smaller. The driving force in attaining one of these equilibria is the parental socialization effort, which depends on the distribution of preferences in their population as well as their expectations about future policies of the principal. The principal's policy is however, determined by the profit gaps between two projects when agents exert either high effort or low effort. Depending on the parameter values, specially the chance of receiving higher wages by lower effort making insiders and the disutility perceived by higher effort making outsiders while working with lower effort making insiders, the economy will converge to an efficient equilibrium with the principal's profits higher from adopting discriminating (fair) strategy profile, when the pay dispersion in the public sector is relatively higher (lower) than that in the private sector. The reverse is true for the economy converging to an inefficient equilibrium.

We have also found that even if the pay dispersion in the public sector is high enough to provide incentives for intergenerational transmission of a *work ethic*, the quantum of reservation should be low enough to make the compensatory-discrimination policy outcome efficient. The mechanism through which changes in the degree of the reservation policy affects the *work ethic* preference dynamics of insiders and outsiders are different, though. A higher level of quota, for instance, demotivates the work-loving outsider parents to transmit their trait to their children. The opposite happens for the leisure-loving insider parents. For the principal, an increase in the level of reserved jobs reduces the his or her profits obtained in industry with job reservation and induces him or her to switch to adopt a *fair strategy*. This structural change in the principal's strategy will push the economy to converge to the efficient equilibrium without compensatory discrimination policy.

This study therefore, provides an alternative explanation why compensatory-discrimination policies have not generated desired outcomes and different degrees of the reservation policy cause very different long-run economic performances. Our model also infers that the compensatory discrimination policy, under certain circumstances, may not adversely affect employer's profit and economic growth, both being positively correlated to the fraction of work-loving agents, thereby discarding the possibility of a trade-off between benefits gained by the low-caste agents and economic growth.

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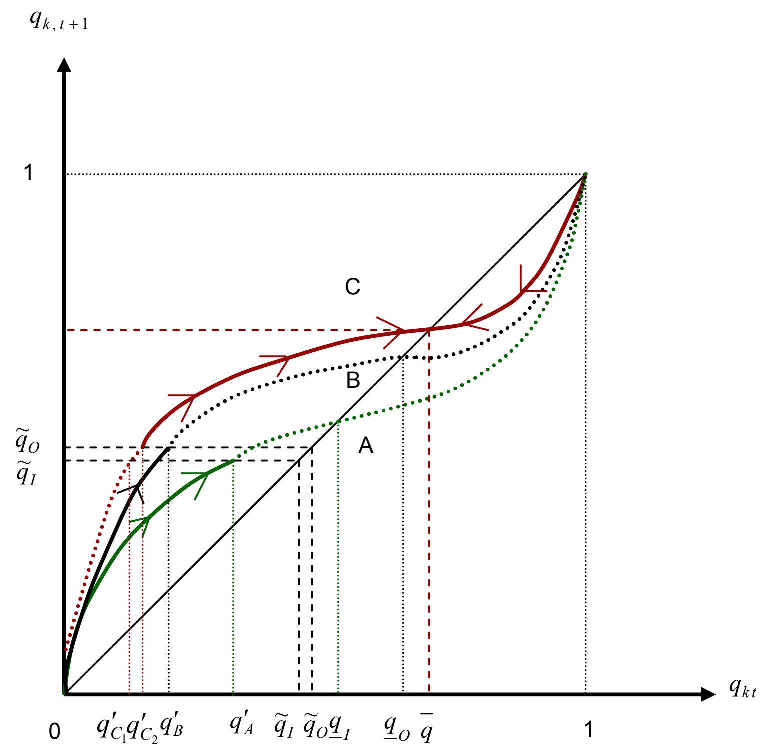

Fig. 1: Convergence to the efficient steady state $(\bar{q}, \bar{q})$, when $\tilde{q}_O < \underline{q}_I$.

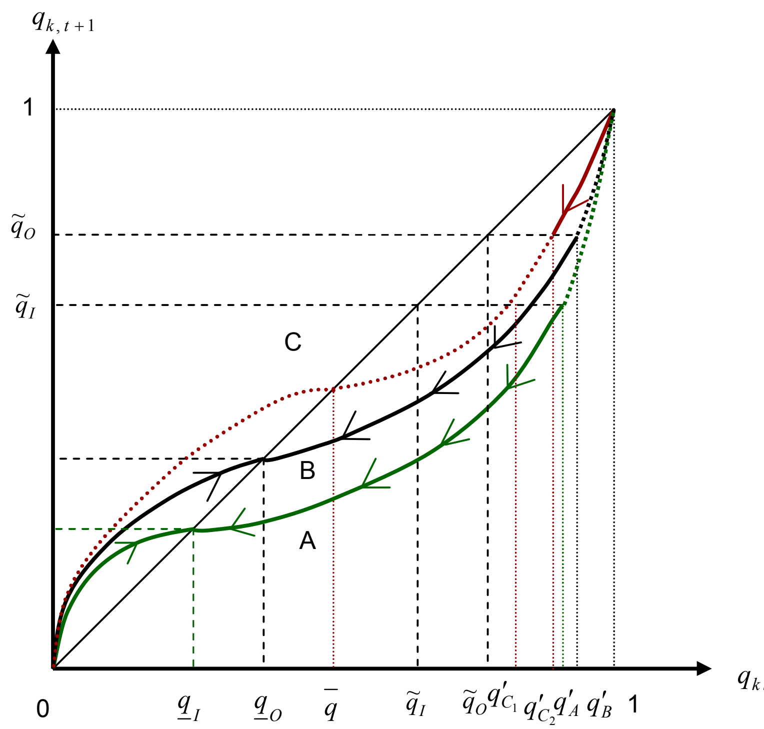

Fig. 2: Convergence to the inefficient steady states $\left(\underline{q}_I, \underline{q}_O\right)$, when $\bar{q} < \tilde{q}_I$.

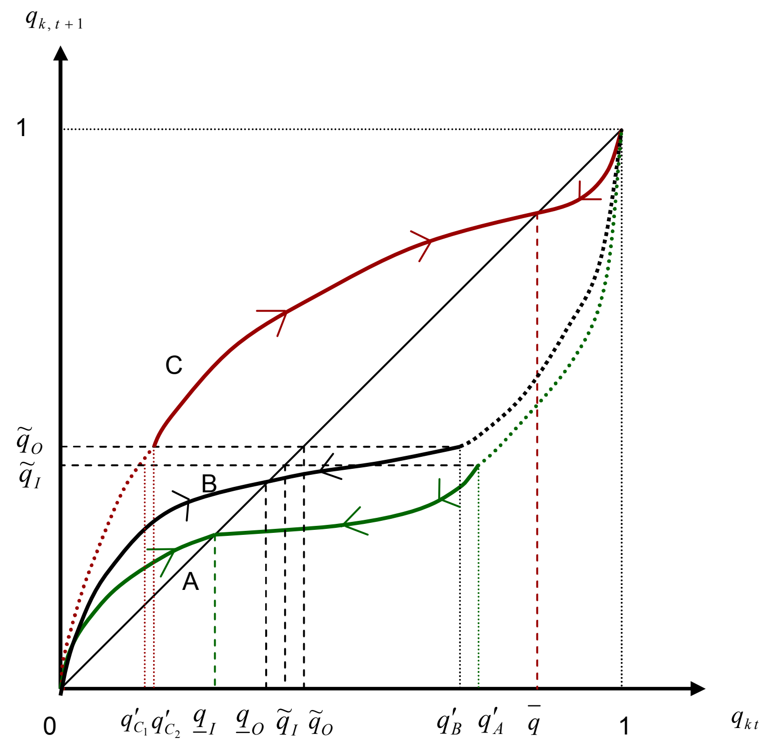

Fig. 3: Convergence to the *efficient* steady state $\left(\bar{q}, \bar{q}\right)$, or to the *inefficient* steady states $\left(\underline{q}_I, \underline{q}_O\right)$, when $\underline{q}_I < \underline{q}_O < \tilde{q}_I < \tilde{q}_O < \bar{q}$.

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Appendix A. Proof of Proposition 1

Substituting $\Delta V_k^i\left(\left\{\sigma^D\right\}_{t+1}^{\infty}\right)$ into (11) and (12) we compute $\hat{\tau}_k^i\left(q_{kt},\left\{\sigma^D\right\}_{t+1}^{\infty}\right)$ and then differentiation with respect to Q yields

$$\frac{d\hat{\tau}_I^W\left(q_{It},\left\{\sigma^D\right\}_{t+1}^{\infty}\right)}{dQ} = -\psi\,\alpha'(Q)\Delta w_2\left(1-q_{It}\right) < 0\,;$$

$$\frac{d\hat{\tau}_I^L\left(q_{It},\left\{\sigma^D\right\}_{t+1}^{\infty}\right)}{dQ} = \psi\,\alpha'(Q)\Delta w_2\, q_{It} > 0\,;$$

$$\frac{d\hat{\tau}_O^W\left(q_{Ot},\left\{\sigma^D\right\}_{t+1}^{\infty}\right)}{dQ} = -\psi\,\gamma'(Q)\left(1-q_{Ot}\right) < 0\,;$$

$$\frac{d\hat{\tau}_O^L\left(q_{Ot},\left\{\sigma^D\right\}_{t+1}^{\infty}\right)}{dQ} = \psi\,\gamma'(Q)\,q_{Ot} > 0\,.$$

Q.E.D.

Appendix B. Proof of Lemma 1

From (11) and (12), we can derive that

$$\tau_k^W\left(q_{kt},\left\{\sigma_z\right\}_{z=t+1}^{\infty}\right) > \tau_k^L\left(q_{kt},\left\{\sigma_z\right\}_{z=t+1}^{\infty}\right)$$

$$\text{if} \qquad q_{kt} < \frac{\Delta V_k^W\left(\left\{\sigma_z\right\}_{z=t+1}^{\infty}\right)}{\Delta V_k^W\left(\left\{\sigma_z\right\}_{z=t+1}^{\infty}\right)+\Delta V_k^L\left(\left\{\sigma_z\right\}_{z=t+1}^{\infty}\right)}\,. \tag{B.1}$$

After computing the R.H.S. of (B.1) for the insider and outsider agents under the expected strategy profiles $\left\{\sigma^F\right\}_{t+1}^{\infty}$, $\left\{\sigma^M\right\}_{t+1}^{\infty}$ and $\left\{\sigma^D\right\}_{t+1}^{\infty}$ and comparing these values with $\bar{q}$, $\underline{q}_O$ and $\underline{q}_I$, we can get the results as stated in Lemma 1.

Q.E.D.

Appendix C. Proof of Proposition 2

Given that $\tilde{q}_I < \tilde{q}_O < \underline{q}_I < \underline{q}_O < \bar{q}$. If $\tilde{q}_I < \underline{q}_I < \bar{q}$, then $\underline{q}_I$ cannot be a rest point of the two-branch dynamics for the insiders (dynamics (A) and (C)), because for all $q_{It} > \tilde{q}_I$, the relevant preference dynamics is (C). Also when $\tilde{q}_O < \underline{q}_O < \bar{q}$, $\underline{q}_O$ cannot be a rest point of the two-branch dynamics for the outsiders (dynamics (B) and (C)), because for all $q_{Ot} > \tilde{q}_O$, dynamics (C) holds. The dynamics (C) has three rest points: $q_k = 0$, $q_k = 1$ and $q_k = \bar{q}$.

We show first that $q_k = 0$ and $q_k = 1$ are locally unstable. Denote $q_{k,\,t+1}$ as $F(q_k)$ in (18). Then differentiation yields

$$
\begin{aligned}
F'(q_k) = \frac{dq_{k,\,t+1}}{dq_{kt}} &= 1 + (1 - 2q_k)\psi\left[\Delta V_k^W(\cdot)(1 - q_k) - \Delta V_k^L(\cdot)q_k\right] \\
&\quad - q_k(1 - q_k)\psi\left[\Delta V_k^W(\cdot) + \Delta V_k^L(\cdot)\right]
\end{aligned}
\tag{C.1}
$$

Since $\psi > 0$, $\Delta V_k^W(\sigma^f) > 0$ and $\Delta V_k^L(\sigma^f) > 0$, we obtain the following results when evaluating the derivative (C.1) at $q_k = 0$ and $q_k = 1$:

$$
F'(0) = \left.\frac{dq_{k,\,t+1}}{dq_{kt}}\right|_{q_{kt} = q_{k,\,t+1} = 0} = 1 + \psi\,\Delta V_k^W(\cdot) > 1\,, \tag{C.2}
$$

$$
F'(1) = \left.\frac{dq_{k,\,t+1}}{dq_{kt}}\right|_{q_{kt} = q_{k,\,t+1} = 1} = 1 + \psi\,\Delta V_k^L(\cdot) > 1\,, \tag{C.3}
$$

Therefore, $q_k = 0$ and $q_k = 1$ are locally unstable.

We further differentiate (C.1) with respect to q_k and obtain:

$$
F''(q_k) = -2\psi\left[\Delta V_k^W(\cdot)(1 - q_k) - \Delta V_k^L(\cdot)q_k\right] - 2\psi(1 - 2q_k)\left[\Delta V_k^W(\cdot) + \Delta V_k^L(\cdot)\right]. \tag{C.4}
$$

The dynamics $F(q_k)$ has a turning point ($\hat{q}_k$) when $F''(q_k) = 0$, where

$$
\hat{q}_k \equiv \frac{1}{3}\left(1 + \frac{\Delta V_k^W(\hat{\sigma})}{\Delta V_k^W(\hat{\sigma}) + \Delta V_k^L(\hat{\sigma})}\right) = \frac{1}{3}\left(1 + q_k^{\,*}\right). \tag{C.5}
$$

If $q_k > \hat{q}_k$, then $F''(q_k) > 0$ implying that $F(q_k)$ is convex when $\hat{q}_k < q_k < 1$. On the other hand, if $q_k < \hat{q}_k$, then $F''(q_k) < 0$ which implies that $F(q_k)$ is concave when $0 < q_k < \hat{q}_k$. Also note that the dynamics (C) lies above dynamics (B) which lies above dynamics (A).

We now turn to prove the global stability of $\bar{q}$. Define $q'_A < \tilde{q}_I$, such that $F_A(q'_A) = \tilde{q}_I$ and $q'_{C_1} < \tilde{q}_I$ such that $F_C(q'_{C_1}) = \tilde{q}_I$. Also define $q'_B < \tilde{q}_O$, such that $F_B(q'_B) = \tilde{q}_O$ and

$q'_{C_2} < \tilde{q}_O$ such that $F_C(q'_{C_2}) = \tilde{q}_O$. For any particular value of the parameters, $q'_A > q'_{C_1}$ and $q'_B > q'_{C_2}$ always. The existence and uniqueness of q'_A , q'_{C_1} , q'_B and q'_{C_2} are shown below.

We first show that $\forall\ q_{I0} \in (0, 1)$ and $\forall\ q_{O0} \in (0, 1)$ there is a perfect foresight path of distribution of preferences for insiders and outsiders that converge to the steady state $(\bar{q}, \bar{q})$:

(a) Assume $q_{It} < q'_{C_1}$ and $q_{Ot} < q'_{C_2}$. If the insider parents expect $q_{It} < q^E_{I,t+1} < \tilde{q}_I$ and the outsider parents expect $q_{Ot} < q^E_{O,t+1} < \tilde{q}_O$, the relevant preference dynamics for the insiders is (A) and that for the outsiders is (B). Then by lemma 1, we have $\tau^W_k(q_{kt}, \sigma^D) > \tau^L_k(q_{kt}, \sigma^D)$. Therefore, $q^E_{k,t+1} = q_{k,t+1} > q_{kt}$ and the expectations are self-confirmed.

(b) Assume $q'_A > q_{It} \geq q'_{C_1}$ and $q'_B > q_{Ot} \geq q'_{C_2}$. If the insider parents expect $q_{It} < \tilde{q}_I \leq q^E_{I,t+1}$ and the outsider parents expect $q_{Ot} < \tilde{q}_O \leq q^E_{O,t+1}$, there will be a switch in the strategy with the principal adopting a σ^F strategy profile. Then, by lemma 1, we have $\tau^W_k(q_{kt}, \sigma^F) > \tau^L_k(q_{kt}, \sigma^F)$. Therefore, $q^E_{k,t+1} = q_{k,t+1} \geq \tilde{q}_k > q_{kt}$ and the expectations are fulfilled.

(c) Assume $q'_A < q_{It} < \bar{q}$ and $q'_B < q_{Ot} < \bar{q}$. If the insider and outsider parents expect $q_{kt} < q^E_{k,t+1} < \bar{q}$, the relevant preference dynamics for both of them is (C). Then $\tau^W_k\left(q_{kt}, \{\sigma^F\}^{\infty}_{t+1}\right) > \tau^L_k\left(q_{kt}, \{\sigma^F\}^{\infty}_{t+1}\right)$). Therefore, $q^E_{k,t+1} = q_{k,t+1} > q_{kt}$ and the expectations are fulfilled.

(d) Assume $q_{kt} > \bar{q}$. If the insider and outsider parents expect $q_{kt} > q^E_{k,t+1} > \bar{q}$, the relevant preference dynamics for them is (C). Then by lemma 1, $\tau^W_k\left(q_{kt}, \{\sigma^F\}^{\infty}_{t+1}\right) < \tau^L_k\left(q_{kt}, \{\sigma^F\}^{\infty}_{t+1}\right)$. Therefore, $q^E_{k,t+1} = q_{k,t+1} < q_{kt}$ and the expectations are self-confirmed.

Notice that by lemma 1, $\tau^W_k\left(q_{kt}, \{\sigma^F\}^{\infty}_{t+1}\right) \gtreqless \tau^L_k\left(q_{kt}, \{\sigma^F\}^{\infty}_{t+1}\right)$ when $q_{kt} \lesseqgtr \bar{q}$, implying that $q_{k,t+1} \gtreqless q_{kt}$ when $q_{kt} \lesseqgtr \bar{q}$. Hence there exists a steady state $\bar{q} \in (0, 1)$.

Evaluating the derivative (C.1) at the steady state $q_k = \bar{q}$, we obtain

$$F'\left(\bar{q}\right) = \left.\frac{dq_{k,\,t+1}}{dq_{kt}}\right|_{q_{kt} = q_{k,\,t+1} = \bar{q}} = 1 - \bar{q}\left(1-\bar{q}\right)\psi\left[\Delta V_k^W(\cdot) + \Delta V_k^L(\cdot)\right]. \tag{C.6}$$

Note that the second term in (C.1) vanishes as $\tau_k^W\left(\bar{q},\, \left\{\sigma^F\right\}_{t+1}^{\infty}\right) = \tau_k^L\left(\bar{q},\, \left\{\sigma^F\right\}_{t+1}^{\infty}\right)$ by lemma 1.

Let $\hat{\tau}_k^W\left(\bar{q}\right) = \hat{\tau}_k^L\left(\bar{q}\right) = \bar{\tau}$. Then by (11) and (12), we have $\psi\,\Delta V_k^W(\cdot) = \dfrac{\bar{\tau}}{1-\bar{q}}$ and $\psi\,\Delta V_k^L(\cdot) = \dfrac{\bar{\tau}}{\bar{q}}$. Substituting these values into (C.6), we obtain $F'\left(\bar{q}\right) = 1 - \bar{\tau}$. As $\bar{\tau} \in (0, 1)$, then $F'\left(\bar{q}\right) \in (0, 1)$. Given that the function $F(q_k)$ is a polynomial of third degree and that $F'(0) > 1$, $F'(1) > 1$ and $F'\left(\bar{q}\right) \in (0, 1)$, there are two possibilities to get global stability of $\bar{q}$.[21] A sufficient condition for global stability of $\bar{q}$ is that $F_C'(q_{It}) > 0$ and $F_A'(q_{It}) > 0$ for all $q_{It} \in (0, 1)$; $F_C'(q_{Ot}) > 0$ and $F_B'(q_{Ot}) > 0$ for all $q_{Ot} \in (0, 1)$. The above sufficient conditions in case of insiders and outsiders hold when $C(\tau)$ is convex enough, in particular, $C''(\tau) = 1/\psi \geq \Delta w_1\left(1 - \dfrac{\Delta w_1}{\mu}\right)$ for both the insiders and outsiders.

Finally we turn back to the existence and uniqueness of q_A', q_{C_1}', q_B' and q_{C_2}'. Notice that $F_A'(q_{It}) > 0$ for all $q_{It} \in (0, 1)$, $F_A(\tilde{q}_I) > \tilde{q}_I$ and $F_A(0) = 0$, implying that there exists a unique $q_A' \in (0, \tilde{q}_I)$, such that $F_A(q_A') = \tilde{q}_I$. A similar argument applies for q_{C_1}'. Further, notice that $F_B'(q_{Ot}) > 0$ for all $q_{Ot} \in (0, 1)$, $F_B(\tilde{q}_O) > \tilde{q}_O$ and $F_B(0) = 0$, implying that there exists a unique $q_B' \in (0, \tilde{q}_O)$, such that $F_B(q_B') = \tilde{q}_O$. A similar argument applies for q_{C_2}'.

Q.E.D.

Appendix D. Proof of Proposition 3

Given that $\underline{q}_I < \underline{q}_O < \bar{q} < \tilde{q}_I < \tilde{q}_O$. If $\underline{q}_I < \bar{q} < \tilde{q}_I$, then $\bar{q}$ cannot be a rest point of the two-branch dynamics for the insiders (dynamics (A) and (C)), because for all $q_{It} < \tilde{q}_I$, the relevant preference dynamics is (A), which has three rest points: $q_I = 0$, $q_I = 1$ and $q_I = \underline{q}_I$. Further, if $\underline{q}_O < \bar{q} < \tilde{q}_O$, then $\bar{q}$ cannot be a rest point of the two-branch dynamics

[21] See Olcina and Penarrubia (2004) and Escriche et al. (2004).

for the outsiders (dynamics (B) and (C)), because for all $q_{Ot} < \widetilde{q}_O$, the relevant preference dynamics is (C), which has three rest points: $q_O = 0$, $q_O = 1$ and $q_O = \underline{q}_O$. Following the same arguments as in the proof of proposition 2, we can show that $q_k = 0$ and $q_k = 1$ are locally unstable, because $\psi > 0$, $\Delta V_k^W(\sigma_z) > 0$ and $\Delta V_k^L(\sigma_z) > 0$ always.

We now turn to prove the global stability of $\underline{q}_I$ and $\underline{q}_O$. Define $q'_A > \widetilde{q}_I$, such that $F_A(q'_A) = \widetilde{q}_I$ and $q'_{C_1} > \widetilde{q}_I$ such that $F_C(q'_{C_1}) = \widetilde{q}_I$. Also define $q'_B > \widetilde{q}_O$ and $q'_{C_2} > \widetilde{q}_O$, such that $F_B(q'_B) = \widetilde{q}_O$ and $F_C(q'_{C_2}) = \widetilde{q}_O$. In general, for any particular value of the parameters, $q'_A > q'_{C_1}$ and $q'_B > q'_{C_2}$. The existence and uniqueness of q'_A, q'_{C_1}, q'_B and q'_{C_2} are shown below.

We first show that $\forall\, q_{I0} \in (0, 1)$ and $\forall\, q_{O0} \in (0, 1)$ there are two distinct perfect foresight path of preferences for insiders and outsiders that converge to the steady state $(\underline{q}_I, \underline{q}_O)$.

(a) Assume $q_{It} > q'_A$ and $q_{Ot} > q'_B$. If the insider parents expect $q_{It} > q^E_{I,t+1} > \widetilde{q}_I$ and the outsider parents expect $q_{Ot} > q^E_{O,t+1} > \widetilde{q}_O$, dynamics (C) holds. Then, by lemma 1, we have $\tau_k^W(q_{kt}, \sigma^F) < \tau_k^L(q_{kt}, \sigma^F)$. Therefore, $q_{kt} > q^E_{k,t+1} = q_{k,t+1} > \widetilde{q}^k$, and the expectations are fulfilled.

(b) Assume $q'_{C_1} < q_{It} \leq q'_A$ and $q'_{C_2} < q_{Ot} \leq q'_B$. If the insider parents expect $q^E_{I,t+1} < \widetilde{q}_I < q_{It}$ and the outsider parents expect $q^E_{O,t+1} < \widetilde{q}_O < q_{Ot}$, there will be a switch in the strategy with the principal adopting a σ^D strategy profile. By lemma 1, we have $\tau_k^W(q_{kt}, \sigma^D) < \tau_k^L(q_{kt}, \sigma^D)$. Therefore, $q^E_{k,t+1} = q_{k,t+1} < q_{kt}$ and the expectations are self-confirmed.

(c) Assume $q'_{C_1} > q_{It} > \underline{q}_I$ and $q'_{C_2} > q_{Ot} > \underline{q}_O$. If the insider and outsider parents expect $q_{It} > q^E_{I,t+1} > \underline{q}_I$ and $q_{Ot} > q^E_{O,t+1} > \underline{q}_O$, the relevant preference dynamics for the insiders is (A) and that for the outsiders is (B). Then $\tau_k^W(q_{kt}, \sigma^D) < \tau_k^L(q_{kt}, \sigma^D)$. Therefore, $q^E_{k,t+1} = q_{k,t+1} < q_{kt}$ and the expectations are self-confirmed.

(d) Assume $q_{It} < \underline{q}_I$ and $q_{Ot} < \underline{q}_O$. If the insider and outsider parents expect $q_{It} < q^E_{I,t+1} < \underline{q}_I$ and $q_{Ot} < q^E_{O,t+1} < \underline{q}_O$, the relevant preference dynamics for the insiders is (A) and for the outsiders is (B). Then we have $\tau^W_k\left(q_{kt}, \sigma^D\right) > \tau^L_k\left(q_{kt}, \sigma^D\right)$. Therefore, $q^E_{k,t+1} = q_{k,t+1} > q_{kt}$ and the expectations are self-confirmed.

Following the same argument as in proposition 2, we can show that $F'(\underline{q}_I) \in (0, 1)$ and $F'(\underline{q}_O) \in (0, 1)$. Given that the function $F(q_k)$ is a polynomial of third degree and that $F'(0) > 1$, $F'(1) > 1$ and $F'(\underline{q}_I) \in (0, 1)$, $F'(\underline{q}_O) \in (0, 1)$ there exist global stability. A sufficient condition for global stability of $\underline{q}_I$ is that $F'_C(q_{It}) > 0$ and $F'_A(q_{It}) > 0$ for all $q_{It} \in (0, 1)$; and that of $\underline{q}_O$ is that $F'_C(q_{Ot}) > 0$ and $F'_B(q_{Ot}) > 0$ for all $q_{Ot} \in (0, 1)$. The above sufficient conditions in case of insiders and outsiders hold when $C(\tau)$ is convex enough, in particular, $C''(\tau) = 1/\psi \geq (1-\alpha(Q))\,\Delta w_2 \left[1 - \frac{(1-\alpha(Q))\,\Delta w_2}{\mu}\right]$ for the insiders and

$C''(\tau) = 1/\psi \geq \left[\Delta w_2 - \gamma(Q)\right]\left[1 - \frac{\Delta w_2 - \gamma(Q)}{\mu}\right]$ for the outsiders.

Also notice that $F'_A(q_{It}) > 0$ for all $q_{It} \in (0, 1)$, $F_A(\tilde{q}_I) < \tilde{q}_I$ and $F_A(1) = 1$, implying that there exists a unique $q'_A \in (\tilde{q}_I, 1)$, such that $F_A(q'_A) = \tilde{q}_I$. A similar argument applies for q'_{C_1}. Further, notice that $F'_B(q_{Ot}) > 0$ for all $q_{Ot} \in (0, 1)$, $F_B(\tilde{q}_O) < \tilde{q}_O$ and $F_B(1) = 1$, implying that there exists a unique $q'_B \in (\tilde{q}_O, 1)$, such that $F_B(q'_B) = \tilde{q}_O$. A similar argument applies for q'_{C_2}.

Q.E.D.

Appendix E. Proof of Proposition 4

Let us prove the proposition for insiders and the similar argument follows for outsiders. To prove part (i) of the proposition we first construct the two perfect foresight paths of preferences which exist for any $q_{I0} \in [q'_{C_1}, q'_A]$. For any $q_{It} \in [q'_{C_1}, q'_A]$ and the insider parents expecting σ^d, lemma 1 indicates that $\tau^W_I\left(q_{It}, \sigma^d\right) \gtrless \tau^L_I\left(q_{It}, \sigma^d\right)$ for $q_{It} \lesseqgtr \underline{q}_I$. Thus,

$q^E_{I,\,t+1} = q_{I,\,t+1} \gtrless q_{It}$ if $q_{It} \lesseqgtr \underline{q}_I$. The perfect foresight path will converge to $\underline{q}_I$. On the other hand, if the insider parents expecting σ^f, lemma 1 indicates that $\tau^W_I\left(q_{It}, \sigma^f\right) \gtrless \tau^L_I\left(q_{It}, \sigma^f\right)$ for $q_{It} \lesseqgtr \bar{q}$. Thus, $q^E_{I,\,t+1} = q_{I,\,t+1} \gtrless q_{It}$ if $q_{It} \lesseqgtr \bar{q}$. The perfect foresight path will converge to $\bar{q}$.

We now prove part (ii) of the proposition. First, if $\underline{q}_I < q'_{C_1}$, then for all $q_{I0} \in \left(0, q'_{C_1}\right)$, the insider parents expect σ^d. Lemma 1 indicates that $\tau^W_I\left(q_{It}, \sigma^d\right) \gtrless \tau^L_I\left(q_{It}, \sigma^d\right)$ for $q_{It} \lesseqgtr \underline{q}_I$. Thus, $q^E_{I,\,t+1} = q_{I,\,t+1} \gtrless q_{It}$ if $q_{It} \lesseqgtr \underline{q}_I$. The perfect foresight path will converge to $\underline{q}_I$. Second, if $\underline{q}_I > q'_{C_1}$, there are two perfect foresight paths. In the first case, the insider parents expect σ^d and the path will converge to $\underline{q}_I$. In the second case, initially the insider parents expect σ^d. But once when the dynamics reaches $q_{It} \in [q'_{C_1}, q'_A]$, the insider parents expect a switch of the strategy to σ^f and the path will converge to $\bar{q}$.

A similar argument proves part (iii) of the proposition.

Q.E.D.