LEADERSHIP AND PEER EFFECTS IN AN HETEROGENEOUS ORGANIZATION

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Introduction

- Why do employees identify with organizational goals? Do organizations depend entirely on motivating agents through their selfish interests?
- Economic theory focusses on monetary or material incentives for agents with given preferences. But we know from psychology and sociology that preferences might change.
- Individuals might have an incentive to conform to the views of others (specially, of leaders).
- Perhaps is cheaper for the Principal to make the agents behave as he desires by socializing the agents to the "right" preferences, instead of providing them the "right" monetary incentives.

Introduction

- Leadership based on power: the ability to influence others´ behavior by rewards and punishment.
- Nevertheless, many times you cannot use money and penalties to align incentives.
- Leadership based on prestige or charisma.
- Indoctrination, that is aligning preferences, might be a useful alternative (see for instance, the army, a religious order or a revolutionary party).

Introduction

- The Principal can make the agents conform to his views through indoctrination or socialization, provided he is perceived as a leader by the agents.
- This source of preference change (or preference formation) competes with others also very well-documented in the psychological and sociological literature.
- For instance, the inertia of the agents´ idiosincratic preferences.
- And of special relevance in an organization is the existence of endogenous social norms, that is, social norms of behavior established by your peers.

Introduction

- Consider an organization composed by a Leader (or a Principal) and by a finite group of agents (or followers).
- The Leader has some ideal organization composition or vector of preferred actions one for each agent and can invest in costly socialization trying to instil this "corporate culture" in all the agents of the organization.
- Each agent has as well her ideal action. When an agent makes a decision each period her behavior is driven by two competing motives: she wants her behavior to agree with her personal ideal action and she wants also her behavior to be as close as possible to the average behavior of her peers.

Introduction

- Ideal actions or preferences evolve over time. There are two sources of preference change.
- On the one hand, there exists a costly corporate socialization effort exerted by the Leader trying to transform the ideal action of each agent into his own ideal action.
- On the other hand, each agent's ideal action changes in the direction of actual behavior (consistency or cognitive dissonance).
- We are interested in the long-run outcomes of this situation and in particular in the ability of the Leader to fully instil the corporate culture in the members of the organization.

Literature

- Economics literature on conformity and endogenous social norms: **Akerlof, 1980, Bernheim, 1994, Gillen, 1994, Kandel and Lazear, 1992, Akerlof, 1997, Kandori, 2002, Huck, Kübler and Weibull, 2006, Fischer and Huddart, 2008.**
- Corporate culture in a dynamic model: **Kandori, 2002 and Rob and Zemsky, 2002.**
- Peer effects and social networks: **Cabrales, Calvó-Armengol and Zenou, 2009**
- Cultural transmission: **Cordes, Richerson, McElreath and Strimling, 2006.**

The model

- We consider a finite set of agents $\{1, 2, \ldots, N\}$ and one Leader L. The leader's preferred action for agent i is $\bar{S}_i$ (time-independent).
- Each agent $i = 1, \ldots, N$ has at time t an ideal action S_i^t and makes a decision on an action x_i^t from the same compact set of actions, obtaining at (discrete) time step t the instantaneous utility:

$$u_i^t(x_i^t) = -\omega_i(x_i^t - \langle x^t \rangle)^2 - (x_i^t - S_i^t)^2 \qquad (1)$$

for $i = 1, \ldots, N$ and being ω_i a conformity weight that measures the

intensity of the social (endogenous) norm.

The model

- We will assume that in each period there is immediate behavioral adjustment that maintains equilibrium play. Therefore, at period t agents play the Nash equilibrium $\hat{x}_i^t$ of the simultaneous game in which each one has the above utility function.
- Define the weighted average:

$$\langle\langle S^t \rangle\rangle = \frac{\left\langle \frac{S^t}{1+\tilde{\omega}} \right\rangle}{\left\langle \frac{1}{1+\tilde{\omega}} \right\rangle} \tag{2}$$

- The Nash equilibrium (NE) is:

$$\hat{x}_i^t = \frac{S_i^t + \tilde{\omega}_i \langle\langle S^t \rangle\rangle}{1 + \tilde{\omega} i}. \tag{3}$$

where $\tilde{\omega}_i \equiv \omega_i \left(1 - \frac{1}{N}\right)$.

Steps

- No leader: self-consistency.
- A Leader with a given charisma.
- A Forward-looking Leader: Costly socialization with cultural distance considerations.

The Dynamics without a leader: self-consistency

- Ideal actions or preferences S_i^t gradually evolve over time.
- This is a two-speed dynamics: gradual changes in preferences are accompanied by immediate behavioral adjustment in each period´s equilibrium play.
- There is no leader in the organization. Nevertheless, the preferences of each member i of the organization evolve in the direction of actual equilibrium behavior.

$$S_i^{t+1} = \gamma \hat{x}_i^t + (1-\gamma) S_i^t, \tag{4}$$

where $\gamma > 0$.
Let us replace the NE:

$$S_i^{t+1} = S_i^t + \gamma \left[\frac{S_i^t + \tilde{\omega}_i \langle\langle S^t \rangle\rangle}{1+\tilde{\omega}_i} - S_i^t \right] = S_i^t + \gamma \frac{\tilde{\omega}_i}{1+\tilde{\omega}_i} \left[\langle\langle S^t \rangle\rangle - S_i^t \right]. \tag{5}$$

The Dynamics: self-consistency

- If $\omega_i = 0$ then $S_i^{t+1} = S_i^t$, a constant value in time. When $\omega_i \neq 0$ the steady solution $S_i^{t+1} = S_i^t \equiv S_i^\infty, \forall i$ (implying $\langle S^{t+1} \rangle = \langle S^t \rangle$) requires for $\gamma \neq 0$ that $S_i^\infty = \langle S^t \rangle$, independent on the agent index i.
- This steady value can be obtained using a conservation law that can be derived from the previous equation. Let N_0 be the number of agents for which the condition $\omega_i = 0$ holds.
- If $N_0 = 0$ (all agents have $\omega_i \neq 0$) the conservation law reduces to:

$$\left\langle \frac{S^{t+1}}{\omega} \right\rangle = \left\langle \frac{S^t}{\omega} \right\rangle . \qquad (6)$$

The Dynamics: self-consistency

- It follows that the common value S_i^∞ in the steady state can be obtained from this expression:

$$S_i^\infty = \frac{\left\langle \frac{S^0}{\omega} \right\rangle}{\left\langle \frac{1}{\omega} \right\rangle}. \tag{7}$$

- This organization tends to complete homogeneity.
- Everybody has as ideal action and plays in equilibrium a weighted average ideal action of the initial condition of the group.

The Dynamics: self-consistency

- If $N_0 \neq 0$, the common value S_i^∞ is determined only from those agents k which satisfy $\omega_k = 0$ (remember that S_k^t is a constant in time for those agents) as:

$$S_i^\infty = \frac{1}{N_0} \sum_{k|\omega_k=0} S_k^0, \qquad i \text{ such that } \omega_i \neq 0. \tag{8}$$

- This organization tends to complete homogeneity (except of non-conformists).
- The long run common ideal action is exclusively determined by the non-conformists.

The Dynamics: a charismatic leader

- Let us assume now that there is a leader endowed with a given charisma vector $d = (d_1, \ldots, d_N)$, where $d_i \in [0, 1)$ for all i, and a vector of target ideal actions,$\bar{S}_i$ one for each member of the organization.
- The dynamics of the preferred actions S_i^t of the members of the organization is now given by:

$$S_i^{t+1} = d_i \bar{S}_i + (1 - d_i) \left(\gamma_i \hat{x}_i^t + (1 - \gamma_i) S_i^t \right), \tag{9}$$

where again $\gamma_i \in [0, 1)$.

The Dynamics: a charismatic leader

- Assume that $\omega_i > 0, \gamma_i > 0$ and $d_i > 0$, $\forall i$ and that $\bar{S}_i$ is statistically independent of ω_i, γ_i and d_i, then the steady state of the above dynamics is given by: $S_i^{\infty} = \dfrac{d_i \bar{S}_i + (1-d_i)\tilde{\gamma}_i \langle \bar{S} \rangle}{d_i + (1-d_i)\tilde{\gamma}_i}$, $i = 1, \ldots, N$, where $\tilde{\gamma}_i = \dfrac{\gamma_i \tilde{\omega}_i}{1+\tilde{\omega}_i}$.

The Dynamics: a charismatic leader

- There is no influence of the initial condition of the organization $S^0 = (S_1^0, S_2^0, ...S_N^0)$ in the steady state outcome. This sharply contrasts with the result for an organization with no leader.
- Note that even if $d_i = d$, $\forall i$ the organization does not tend to homogeneity. The steady state ideal action of each agent is a convex combination of the particular target of the leader for her $\bar{S}_i$ and the average target for the organization $\langle \bar{S} \rangle$.
- The steady state value S_i^∞ is closer to the target $\bar{S}_i$, the higher is the charisma d_i of the leader with agent i, the smaller is the consistency of agent i γ_i and the smaller is the level of conformism ω_i.
- Only if the leader pursues a completely homogeneous organization with exactly the same target $\bar{S}$ for all its members, he will succeed in the long run provided he has positive levels of charisma with all the individuals. In any other case, he never succeeds.

The Dynamics: a charismatic leader

- The dispersion σ^2

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}(S_i^\infty - \bar{S}_i)^2. \tag{10}$$

is a measure of the success of the Leader. The lower is this variance, the higher is the leader's success.

- If we make the independence assumption, it simplifies to:

$$\sigma^2 = \left\langle \left(S^\infty - \overline{S}\right)^2 \right\rangle = \left\langle \left(\frac{(1-d)\tilde{\gamma}}{d+(1-d)\tilde{\gamma}}\right)^2 \right\rangle \sigma^2[\overline{S}]. \tag{11}$$

- The determinants of σ^2 are, besides $\sigma^2[\bar{S}]$, the size and dispersion of the distributions of charisma ,d_i, conformity ω_i and consistency γ_i in the group.

The Dynamics: a charismatic leader

- For any given target of the leader with variance $\sigma^2[\bar{S}]$, the variance σ^2 is lower, that is, the success of the leader is higher, the higher is charisma d and the lower are the levels of conformity ω and consistency γ of the followers.
- Assume that there is a mean preserving spread (MPS) in the distribution of the levels of charisma d_i. A well-known result states that a MPS increases the expected value of any convex function. These will result in an increase of σ^2. The success of the leader diminishes when his charisma is more dispersedly distributed across the organization.

A charismatic leader:

An organization with irreducible agents

- Let D be the set of agents such that $\tilde{\gamma}_i \omega_i = 0$ and $d_i = 0$. We are going to denote this set of agents as the irreducible agents of the organization.

Proposition

- *If there is a subset D of N_0 irreducible agents in the organization, N_1 agents with $d_i > 0$ and $\bar{S}_i$ is statistically independent of ω_i, γ_i and d_i, then the steady state of the dynamics for the rest $(N - N_0)$ members of the organization (subset D^c) is given by:*

$$S_i^\infty = a_i \bar{S}_i + (1 - a_i) \left[\frac{(N_1/N) \left\langle \frac{d}{(d+(1-d)\tilde{\gamma})(1+\tilde{\omega})} \right\rangle_{A \cup C} \langle \bar{S} \rangle_{A \cup C} + (N_0/N) \left\langle \frac{S^0}{1+\tilde{\omega}} \right\rangle_D}{((N-N_0)/N) \left\langle \frac{d}{(d+(1-d)\tilde{\gamma})(1+\tilde{\omega})} \right\rangle_{D^c} + (N_0/N) \left\langle \frac{1}{1+\tilde{\omega}} \right\rangle_D} \right],$$

where $a_i = \frac{d_i}{d_i + (1-d_i)\tilde{\gamma}_i}$.

The leader chooses the levels of costly socialization efforts

- The leader chooses a sequence of vectors of costly socialization efforts, $d^t = (d_1^t, \ldots, d_N^t)$, each $d_i^t \in [0,1)$, trying to reduce the distance between each ideal action S_i and his targeted $\bar{S}_i$ for each agent. His objective is to maximize $-\sum_{i=1}^{N}(\bar{S}_i - S_i^{t+1})^2$.
- Socialization effort or investment in charisma or prestige is costly, according to a cost function with two arguments: the level of effort and the "cultural distance" between $\bar{S}_i$ and S_i^*. Formally. the cost function is

$$c(d_i^t, |\bar{S}_i - S_i^{*t}|) = \frac{\beta}{2}(d_i^t)^2(\bar{S}_i - S_i^{*t})^2$$

  with $\beta > 0$, where $S_i^{*t} = \tilde{\gamma}(\langle S^t \rangle) + (1-\tilde{\gamma})(S_i^t)$.
- The higher is the "cultural" distance between agent i and the leader, the more costly is an additional unit of socialization effort invested in agent i.

The leader chooses the levels of costly socialization efforts

- The dynamic programming problem faced by the Leader is:

$$\begin{array}{lll} \max & \sum_{t=0}^{\mathrm{st}} & \delta^t \{-\sum_{i=1}^{N} [(\bar{S}_i - S_i^{t+i})^2 + \frac{\beta}{2} (d_i^{t)^2} (\bar{S}_i - S_i^{*^t})^2]\} \\ \{d^t\}_{t=0}^{\mathrm{st}} & s.t & d_i^t \in [0,1], t \geq 0, i = 1, \ldots, N \\ & & S_i^{t+1} = d_i^t \bar{S}_i + (1 - d_i^t) S_i^{*^t} \\ & & S_i^{*^t} = S_i^t + \tilde{\gamma}_i [\langle\langle S^t \rangle\rangle - S_i^t] \end{array}$$

S_i^0 given and where $\delta \in (0,1)$ is the discount factor of L.

The leader chooses the levels of costly socialization efforts

- Making a change of control variable the problem can be expressed as:
- $\max \sum_{t=0}^{st} \delta^t \{ - \sum_{i=1}^{N} [((\bar{S}_i - S_i^{t+1})^2] + \frac{\beta}{2}(S_i^{t+1} - S_i^t - \tilde{\gamma}_i(\langle\langle S^t \rangle\rangle - S_i^t))^2] \}$
- choosing $\{S_{t+1}\}_{t=0}^{st}$ s.t.
- $S_i^{t+1} \in [S_i^t, \bar{S}_i] if S_i^t \leq \bar{S}_i$
- $S_i^{t+1} \in [\bar{S}_i, S_i^t] if S_i^t > \bar{S}_i$
- S_i^0 given, $i = 1, \ldots, N$.

The leader chooses the levels of costly socialization efforts

- The Bellman equation of the dynamic programming problem is:

$$V(S^t) = \max_{S^{t+1}} \{ U(S^t, S^{t+1}) + \delta V(S^{t+1}) \}_{\{t=0,1...\}}$$

We want to obtain the optimal socialization policy function $S^{t+1} = h(S^t)$ that maximizes the problem.

The leader chooses the levels of costly socialization efforts

- Given the properties of the instantaneous payoff function $U(S^t, S^{t+1})$ we know that there exist two functions $V(S^t)$ and $h(S^t)$ such that $V(S^t)$ is uniquely defined, continuous, concave and differentiable. Moreover, $h(S^t)$ is single-valued. The optimal socialization plan $h(S^t)$ must satisfy the set of necessary and sufficient conditions whenever S_i^{t+1} are interior.
- We obtain the following set of Euler equations which solve for $h(S^t)$ as the optimal socialization function:
- $\beta(h(S_i^t) - S_i^t - \tilde{\gamma}_i[\langle\langle S^t \rangle\rangle - S_i^t]) - 2(\bar{S}_i - h(S_i^t)) = \delta\alpha_i\beta(h(h(S_i^t)) - h(S_i^t) - \tilde{\gamma}_i \langle\langle h(S_i^t)\rangle\rangle - h(S_i^t)]$
- for $i = 1, \ldots, N$.

The leader chooses the levels of costly socialization efforts

- Equivalently, we can express this as a set of coupled second-order difference equations:
- $\beta(S_i^{t+1} - S_i^t - \tilde{\gamma}_i[\langle\langle S^t \rangle\rangle - S_i^t]) - 2(\bar{S}_i - S_i^{t+1}) =$ $\delta\alpha_i\beta(S_i^{t+2} - S_i^{t+1} - \tilde{\gamma}_i(\langle\langle S^{t+1} \rangle\rangle - S_i^{t+1})]$
- for $i = 1, \ldots, N$ and S_i^0 given.

The leader chooses the levels of costly socialization efforts

- We characterize the solution of this set of coupled second-order difference equations. In the homogeneous case the steady state is given by:

$$S_i^{\infty} = \frac{2\bar{S}_i + \beta(1-\alpha\delta)\tilde{\gamma}\left\langle \bar{S} \right\rangle}{\beta(1-\alpha\delta)\tilde{\gamma} + 2}$$

for $i = 1, \ldots, N$, where $\alpha = 1 - \tilde{\gamma}(1 - 1/N)$.

Further research

- - boundaries of the organization (a single or separate organizations?).
- - team initial composition (recruitment).
- - robustness (exogenous shock on the preferred actions).