Social Trust and Economic Governance

Huang Fali
April 2004

Paper No. 14-2004

ANY OPINIONS EXPRESSED ARE THOSE OF THE AUTHOR(S) AND NOT NECESSARILY THOSE OF THE SCHOOL OF ECONOMICS & SOCIAL SCIENCES, SMU
Social Trust and Economic Governance

Fali Huang
School of Economics and Social Sciences
Singapore Management University
469 Bukit Timah Road, Singapore 259756
Email: flhuang@smu.edu.sg
Tel.: 65-68220859
Fax: 65-68220833

April 23, 2004
Abstract

The paper investigates the dynamic relationship between social trust and economic governance using a principal-agent model with stochastic returns. To mitigate the inherent moral hazard problem both intrinsic and extrinsic incentives are useful. The cooperative tendency of an agent measures his intrinsic discipline against shirking, the distribution of which characterizes social trust in society. The economic governance methods include direct monitoring and efficiency wage. The main results are the following. An agent with a higher cooperative tendency needs less monitoring and a lower wage to make effort, which brings higher profit for the principal. But competition among principals for more cooperative agents drains away the extra profit and passes it on to the agent as a sign-in bonus. So an agent with a higher cooperative tendency ends up earning a higher total income. In the short run when cooperative tendencies are fixed, the distribution of economic governance intensity in the economy is determined by social trust. In the long run when cooperative tendencies are endogenously formed to maximize an agent’s lifetime utility, both social trust and economic governance are determined by fundamentals such as the costs of monitoring, screening, and investing in cooperative tendency. In the steady state, social trust increases in monitoring cost and decreases in screening and investing costs. An important insight the paper delivers is that principals always benefit from a lower monitoring cost but not necessarily from a higher social trust. Both downward and upward movement of social trust and economic governance, once started, would continue monotonically. Their relative strength across societies is preserved or reinforced over time.
1 Introduction

Consider a mother who needs to hire a baby-sitter for several hours. If she finds the candidate baby-sitter trustworthy enough based on interviews and reference letters, she may have a peace of mind that her child would be well taken care of. If the baby-sitter seems not so reliable, the mother may have to install a (hidden) video camera to monitor the baby-sitter’s behavior. The aggregate usage of such monitoring schemes, which varies a lot over time and across societies, is thus affected by how easy it is to find a trustworthy baby-sitter. On the other hand, the supply of trustworthy baby-sitters is not completely exogenous since it takes a lot of time and effort to inoculate trustworthiness in a person.\textsuperscript{1} To illustrate this point, suppose some day in future technologies are so advanced that perfect monitoring incurs only a negligible cost. Would a mother still try to find a trustworthy baby-sitter? Not anymore, since all baby-sitters would behave the same when their effort is fully observed and rewarded. Given this, would parents still take the trouble to bring up trustworthy children? Maybe not.\textsuperscript{2}

This baby-sitter example suggests two distinct but interdependent ways of reducing moral hazard in a principal-agent relationship: intrinsic and extrinsic incentives. A society may spend resources increasing intrinsic trustworthiness in its citizens or reducing monitoring costs through technologies and mechanisms. The resource allocation decisions are made by many rational individuals, which in aggregation shape the evolution paths of social trust and economic governance.

This paper formalizes these insights in the context of a principal-agent model and across-generation dynamics where an agent’s cooperative tendency is endogenously chosen to maximize his life-time utilities. Given the extrinsic incentives, an agent’s trustworthiness in a game is completely determined by his cooperative tendency which by definition measures his intrinsic incentives to cooperate or make effort, and social trust in this economy is characterized by the distribution of cooperative tendencies among agents. The relevant economic governance methods consist of direct monitoring and efficiency wage.

In the basic model cooperative tendencies are perfectly observed. A higher cooperative tendency

\textsuperscript{1}For example, Shavell (2002) claims that “The establishment of moral rules is evidently very expensive from a social perspective, assuming that this occurs through socialization and inoculation. To instill the moral rules ... requires constant effort over the years of childhood (and perhaps reinforcement thereafter). If we regard the duties of parents, schools, and religious institutions as comprised importantly of the teaching of children in the moral dimension, then we can appreciate that society’s investment in imbuing moral rules is substantial.”

\textsuperscript{2}In the other extreme where there is no cost in bringing up trustworthy children, the costly monitoring is not needed anymore.
enables the agent to make effort under less monitoring and a lower efficiency wage, which generates a higher profit for the principal. The resulted competition among principals for cooperative agents, however, passes the extra profit to the agents. At the end of the day, agents with higher cooperative tendencies earn higher incomes which increase in monitoring cost. In the steady state of across-generation dynamics, the cooperative tendency and hence social trust are higher in a society where monitoring is more costly. To the extent that exogenous technologies and knowledge accumulation tend to bring down monitoring costs over time, the decline of social trust is a natural trend. Furthermore, notice that principals do not capture any rent from agent trustworthiness, but their profits can be improved by reducing monitoring cost. So principals have all the incentives in finding cheaper ways to monitor agents rather than improving social trust, which may lead to faster reduction of monitoring cost than the exogenous rate, and hence quicker decline of social trust. This incentive structure in allocating resources between social trust and economic governance also suggests that, if everything else is the same, a society where principals control more resources may have higher intensity of economic governance and lower social trust, and vice versa.

These results still hold up to minor adjustments when the basic model is extended to various cases such as different tasks and costly screening. When there are multiple tasks with different monitoring costs, more cooperative agents are sorted into tasks with higher monitoring costs, but they have to share rents with principals. In the steady state there are still multiple levels of cooperative tendencies. Principals with higher monitoring costs gain more from agent cooperative tendency, and less from monitoring cost reduction. On the other hand, the fact that agents do not get the full rent leads to socially inefficient investment in cooperative tendency (and hence social trust). As the gap of monitoring costs between projects shrinks, the rent captured by principals also decreases and may disappear in the limit. This again demonstrates that for principals any rent from agent trustworthiness is of transitory nature. In other words, a lower monitoring cost would definitely increase profits, while competition may drain away any benefit of hiring a more cooperative agent.

When a positive screening cost has to be paid to observe agent cooperative tendencies, some principals may choose not to screen. And ultimately it is the agents that bear the screening cost, while principals earn a higher profit than the complete information case. This partial rent captured by principals, however, disappears in the long run when cooperative tendencies are endogenously formed to maximize agent utilities. So principals have no incentives in reducing screening costs either. In the steady state some agents are completely selfish while others have identical cooperative
tendency. Besides increasing in monitoring cost, social trust now also decreases in screening cost.

Our results suggest that in the long run both social trust and economic governance are determined by the costs of monitoring, screening, and investing in agents. The reduction processes of these costs, which have different incentive and technical features, would jointly shape the trajectories of social trust and economic governance over time. If we assume that the monitoring cost decreases in the total amount of monitoring used by all principals, then its reduction rate is lower when social trust is higher. On the other hand, since the aggregate marginal benefit of a lower screening cost increases in the proportion of cooperative agents, it follows naturally that the reduction rate of screening cost increases in social trust. If the reduction process of screening cost dominates that of monitoring cost, then social trust would move upward over time. If the contrary is true, then social trust would move downward over time. Across societies, social trust is always lower and economic governance always more intensive in a society where the initial screening cost is higher. These results are consistent with the historical evidence of two trader groups discussed by Greif (1994) and across-community variation of social trust documented by Alesina and Ferrara (2002) among others. They may also account for the broad differences between the organization of Confucian societies and the West.

Recent empirical work in the burgeoning social trust literature shows that both social trust and economic governance are important for economic growth and social welfare (Knack and Keefer, 1997; La Porta et al. 1997; Fukuyama 1995; Putnam 1993, 1995). But little is understood about their complex dynamic relationship. This paper makes contributions in this aspect. It analyzes the dynamic interactions between social trust and economic governance and how they are determined by and then affect economic fundamentals. Many of its results are broadly consistent with both across-sectional variation and time paths of social trust and economic governance.

The economic governance literature often takes as exogenously given different cooperative tendencies of agents, but is unaware of its intimate relationship with social trust. For example, Dixit (2003) assumes three exogenous types namely honest, dishonest, and opportunist when he studies contract governance, where honest agents always cooperate. The same assumption is used by, among others, Tirole (1996) in his study of collective reputation, and Rob and Yang (2003) in their work on long-term relationships. Since both honest and dishonest types are irrational agents who do not maximize their utilities, the feedback from type-specific incomes to type distribution is cut off. This
may be justified in a short time when types are fixed, but not in the long run when types can be
dependently chosen. So a seemingly efficient governance mode in a static environment may have
unintended long run effects on type distribution and turns out to be not optimal. One such example
at the firm level is illustrated by Rob and Zemsky (2002).

In a similar theme to the current paper, Shavell (2002) studies the relative effectiveness of morality
and law as means of control of conduct;5 Sobel (2002) contrasts informal relational contracts with
formal legal institutions in supporting partnerships; and Li (1999) distinguishes between relation-
based and rule-based modes of governance (also see the discussion by Dixit 2003 and Greif 1997).
The emphasis of these studies is the relative merits and costs of different governance modes rather
than their dynamic interactions. It seems plausible that the analytical framework of this paper can
also be fruitfully applied to these cases.

The paper is organized as follows. In the second section a simple principal-agent model is
introduced and across-generational dynamics are analyzed. The basic model is extended to multiple
tasks and positive screening costs in the following two sections. The trajectories and across-sectional
variation of social trust and economic governance are analyzed in details in section five. The final
section concludes.

2 The Basic Model

2.1 The Stage Game: A Simple Principal-Agent Model

A principal hires an agent from a pool of potential candidates to complete a project. The outcome is
stochastic. If the agent makes the appropriate effort \( e \), he produces \( h > 0 \) with probability \( p \in [0, 1] \)
and 0 with probability \( 1 - p \). If the agent shirks, the probability of getting \( h \) is \( q \in (0, 1) \), where
\( q < p \). The cost of effort is \( C(e) \) where \( hp - C(e) > hq \) holds so that making effort \( e \) is the social
optimal choice. Principals are identical with unit mass. The reservation utility of agents and the
alternative return for principals are normalized to zero.

Agents are heterogenous in predisposition to cooperate. There are a continuum of agents indexed
by \( i \in [0, 1] \), where agent \( i \) has a cooperative tendency \( \alpha_i \in [0, +\infty) \) such that he feels guilty of the
amount \( \alpha_i \) if he shirks. The cumulative distribution function of cooperative tendency among agents is

---

5 Actually trustworthiness is arguably the core moral since it enables agents to maximize the social welfare rather
than their selfish ones. Shavell (2002) writes: "Arguably, the only overarching principle that could rationalize all these
diverse (moral) rules is that of a general utilitarianism, of social welfare maximization. It does seem true that a form
of this principle not only could be, but in fact is, imbued in us: the general obligation to do good, to do whatever it
is that helps society."
with support \([0, A]\), which characterizes social trust. As Shavell (2002) has observed, inoculated moral rules are not subject to alteration in the short run; it will often take at least a generation to accomplish that. Indeed, a cooperative tendency is usually formed in one’s childhood and becomes a stable character through one’s life. So the quality of workforce is often considered as a constraint by principals when choosing incentive schemes.

There are many ways to mitigate the inherent moral hazard problem in a principal-agent situation. All of them, however, can be essentially categorized into two distinct groups: some rely on intrinsic incentives of agents and others on extrinsic incentives. For instance, the principal can screen agents to select a trustworthy one through interviews, reference letters, obtaining the agent’s past histories through credit bureau or hiring a detective, etc. This character-based screening aims to make usage of an agent’s intrinsic incentives to cooperate. On the other hand, she can direct the agent’s work personally or monitor the agent through a video camera or accounting and auditing system, and design incentive pays accordingly to make sure appropriate effort is made. These are behavior- or performance-based economic governance schemes which provide extrinsic incentives to induce agents to cooperate. Both types of practices are quite common and often simultaneously used by a principal (see for example Ichiowski et al. 1997). Their distinct characteristics and interactions are illustrated in the paper through the analysis of screening and monitoring plus a fixed wage. The qualitative results would not change if alternative combinations of schemes are used because the fundamental driving forces are the different working mechanisms of intrinsic and extrinsic incentives in achieving cooperation.

Agents are risk averse and thus prefer a constant wage rather than outcome-contingent incomes. To reduce shirking associated with a fixed wage, the principal can use screening and monitoring. Suppose with certain screening cost \(s\) a principal can correctly assess an agent’s cooperative tendency. After an agent’s cooperative tendency \(\alpha_i\) is revealed, the principal chooses wage \(w_i\) and a direct monitoring level \(m_i \in [0, 1]\), where \(m_i\) is the probability that shirking is observed. The total monitoring cost is \(m_i c(k)\) where \(c(k)\) measures the cost of using monitoring technologies such as video cameras in the workplace. If the agent is caught shirking, he will get zero wage.\(^6\)

\(^6\)This simple model arguably captures the essence of more complicated screening and incentive schemes in analyzing the relationship between social trust and economic governance. Allowing imperfect screening and other incentives only change the results in a quantitative aspect without bringing new insights. Similarly, since what repeated interactions can do in mitigating the moral hazard problem is either type-revealing or imposing extra extrinsic incentives, they would not add any new functions beyond those of screening and monitoring in a one-period relationship.
To solve the model analytically we adopt functional forms

\[ C(e) = e^{z+1}, \quad c(k) = k^{z+1}, \quad u(w) = w^{z}, \]

where a common parameter \( z \in (0, 1] \) is used only to simplify notation. We first study the case where the cost of screening is zero.

### 2.1.1 The Optimization Problem

An agent with a cooperative tendency \( \alpha_i \) incurs disutility or guilt \( \alpha_i \) whenever he shirks, regardless of being caught or not by the principal. Given the incentive package \((w_i, m_i)\), the agent gets utility \( w_i - e^{z+1} \) when making effort \( e \) and \( w_i(1 - m_i) - \alpha_i \) if not. He would not shirk if the following condition

\[ w_i - e^{z+1} \geq w_i(1 - m_i) - \alpha_i \]

holds. For agents with \( \alpha_i \leq e^{z+1} \), this leads to the condition for monitoring

\[ m_i \geq w_i^{-z}(e^{z+1} - \alpha_i) \equiv m_i. \]

where \( m_i \) is the minimum monitoring level to deter shirking. Note that \( m_i \) decreases in wage \( w_i \) and cooperative tendency \( \alpha_i \). Since monitoring is costly, the principal always chooses the minimum possible level \( m_i \) just enough to induce the agent to make effort.\(^7\) So the principal’s objective function is

\[
\max_{w_i} Q_{ci} \equiv hp - w_i - w_i^{-z}(e^{z+1} - \alpha_i)k^{z+1}.
\]

The optimal wage is then

\[ w_i^* = \omega k(e^{z+1} - \alpha_i)^{-\frac{1}{z+1}} \]

where \( \omega \equiv z^{\frac{1}{z+1}} \). Note for \( \alpha_i \leq e^{z+1} \) the optimal wage \( w_i^* \) is higher than the agent’s reservation wage zero, which is indeed an efficiency wage to reward appropriate effort and help prevent shirking.

Plug \( w_i^* \) into equation (2) we get the optimal monitoring level

\[ m_i^* = (\omega k)^{-\frac{1}{z+1}}(e^{z+1} - \alpha_i)^{-\frac{1}{z+1}}. \]

The profit from hiring an agent with \( \alpha_i \) is thus

\[ Q_i^* = hp - (1 + z^{-1})\omega k(e^{z+1} - \alpha_i)^{-\frac{1}{z+1}}. \]

\(^7\)Actually positive monitoring is chosen if and only if the monitoring cost is low enough such that \( k \leq \frac{h(p-q)}{(1+z)^{z+1}} \omega e \) holds. See the next footnote for more details.
Both optimal wage $w^*_i$ and monitoring level $m^*_i$ decrease in the agent’s cooperative tendency $\alpha_i$, while the profit increases in $\alpha_i$.

Agents with $\alpha_i \geq e^{z+1}$ always make effort through intrinsic incentives so that no extrinsic incentives are needed. Since the optimal monitoring and wage for them are zero, the highest possible profit $hp$ is achieved. On the other hand, for completely selfish agents with $\alpha_i = 0$, the principal has to use the most intensive incentive package including the highest wage

$$w^* \equiv \omega_k e$$

and the highest monitoring level

$$m^* \equiv (\omega k)^{-z} e$$

to prevent them from shirking. This leads to the lowest profit for a principal

$$Q^* \equiv hp - (1 + z^{-1})\omega ke.$$ (6)

A principal hiring an agent with $\alpha_i$ gets a higher profit $Q^*_i$ than $Q^*$ because she does not need to adopt the most expensive incentive package $(w^*, m^*)$. That is, the intrinsic incentives are substitutes for the extrinsic incentives provided by principals, and the extra profit $Q^*_i - Q^*$ is essentially a rent generated by cooperative tendency $\alpha_i$.

2.1.2 The Equilibrium

Since profit $Q^*_i$ increases in $\alpha_i$, all principals prefer an agent with a higher cooperative tendency. Given that principals are identical and their mass is the same as that of agents, the competition among principals will eventually drive profits to the lowest level $Q^*$ and pass all the rent $Q^*_i - Q^*$ to agents in the form of a sign-in bonus $B^*_i$ where

$$B^*_i = Q^*_i - Q^* = \begin{cases} (1 + z^{-1})\omega k(e - (e^{z+1} - \alpha_i)\frac{1}{1 + x}) & \text{if } \alpha_i \leq e^{z+1} \\ (1 + z^{-1})\omega ke & \text{if } \alpha_i \geq e^{z+1} \end{cases}.$$ (7)

So an agent with $\alpha_i \leq e^{z+1}$ gets income $I^*_i \equiv w^*_i + B^*_i$, the sum of wage and bonus. It is easy to check that agent income increases in both $\alpha_i$ and $k$. It can be rewritten as

$$I^*_i = w^* + \hat{B}(\alpha_i, k)$$

---

8 Actually the lowest expected profit a principal can get is $\max\{Q^*, hq\}$, where $hq$ is achieved when she hires a completely selfish agent with zero wage and no monitoring. This implies that monitoring is chosen if and only if $Q^* \geq hq$, which leads to $k \leq \frac{\lambda(p-q)}{1+e^{z+1}z\omega e}$. 

7
Figure 1: Economic Governance Intensity and Agent Incomes as Functions of Cooperative Tendency

where \( w^* \) is the wage of a selfish player, and

\[
\tilde{B}(\alpha_i) = z^{-1} \omega k \left( e^{e^{z+1} - \alpha_i} - 1 \right)
\]

(8)

is the extra income due to \( \alpha_i \). Since \( \tilde{B}(\alpha_i, k) \) increases in \( \alpha_i \), so does the individual income \( I^*_i \). The selfish agent gets the lowest income equal to his wage \( w^* = \omega ke \). The highest income an agent can get is \((1 + z^{-1})\omega ke\) when \( \alpha_i \geq e^{z+1} \), which is \((1 + z^{-1})\) times that of a selfish agent.9

Similarly, the distributions of monitoring level \( m^*_i \) and wage \( w^*_i \) are completely determined by that of cooperative tendency, where their respective supports are \([0, m^*] \) and \([0, w^*] \). For example, from condition(4) we can get the cumulative distribution function of monitoring \( G(m) \equiv 1 - F(e^{z+1} - z^z(kz^m)^{z+1}) \). This suggests that the overall economic governance intensity in society is determined by social trust. The distributions of income \( I^*_i \), sign-in bonus \( B^*_i \), efficiency wage \( w^*_i \), and monitoring level \( m^*_i \) are illustrated in figure 1.

The social welfare includes the profits of all principals and the incomes of all agents, which is equal to

\[
W = \int_0^{e^{z+1}} (Q^*_i + w^*_i)dF(\alpha_i) + (1 - F(e^{z+1}))hp.
\]

---

9 For example, when \( z = \frac{1}{n} \) the most cooperative agent earns \( n \) times that of a selfish agent even though they have identical producing ability. This illustrates the important effects of non-cognitive skills on individual incomes (see Heckman 1999).
When $\alpha_i$ follows uniform distribution with cdf $F(\alpha_i) = \frac{\alpha_i}{A}$ on the support $[0, A]$, it becomes

$$W = hp - \frac{z + 1}{z + 2}e^{-z}k\frac{e^{z+2}}{A}.$$  

It is straightforward to check that $W$ increases in $A$ and decreases in monitoring cost $k$, where $A$ is a sufficient statistic for social trust level. Furthermore, the marginal gain from increasing social trust is higher when it is more costly to monitor:

$$\frac{\partial^2 W}{\partial A \partial k} = \frac{z + 1}{z + 2}e^{-z}\frac{e^{z+2}}{A^2} > 0.$$

The same condition suggests the marginal gain from reducing monitoring cost $k$ is lower when social trust is higher. These results are summarized in the following proposition.

**Proposition 1** The intensity of economic governance, measured by efficiency wage $w_i^*$ and monitoring level $m_i^*$, decreases in agent cooperative tendency $\alpha_i$. The rent generated by $\alpha_i$ is completely passed to the agent as a sign-in bonus $B_i^*$ due to competition among principals for more cooperative agents. In equilibrium all principals get the same profit $Q^*$ independent of $\alpha_i$, where $Q^*$ decreases in monitoring cost $k$. Agent income $I^*_i$ increases in both $\alpha_i$ and $k$. The marginal gain of social welfare from social trust is higher when monitoring is more costly.

When cooperative tendencies are readily observable with no cost, principals adjust monitoring and wage accordingly to take advantage of agents’ innate disciplines and save on governance cost. Due to perfect competition among identical principals, the full rent is captured by agents as a bonus, leaving all principals with exactly the same profit as if they had hired an agent with zero cooperative tendency. In other words, in equilibrium principals do not get any benefits from hiring a cooperative agent.

### 2.2 Across-Generation Dynamics

In order to understand the dynamic interactions between social trust and economic governance, we have to study the across-generation evolution of cooperative tendency distribution. Suppose all principals live forever, while agents work for one period and die afterwards. Each agent also raises a child and is replaced by the grown-up child when he dies. All children are endowed with the same productivity and zero cooperative tendency, where the latter can be increased by parental investment. Parents are altruistic and try to maximize child lifetime welfare.
2.2.1 Investing in Cooperative Tendency

Since cooperative agents earn extra incomes \( \tilde{B}(\alpha_i) \) in this economy, parents do have incentives in improving their children’s cooperative tendencies. The parental cost of investing in child cooperative tendency \( \alpha_{2i} \) is a convex function in \( \alpha_{2i} \) and decreasing in parent cooperative tendency \( \alpha_{1i} \). The cost function is

\[
c(\alpha_{2i}; \alpha_{1i}) = \frac{c[e^{(z+1)a} - (e^{z+1} - \alpha_{2i})^a]}{(1 + \alpha_{1i})^b},
\]

where \( a, b, c, \in \mathbb{R}^+ \). Note there is no cost in keeping the initial zero cooperative tendency since \( c(\alpha_{2i} = 0; \alpha_{1i}) = 0 \). So the net return of investing in \( \alpha_{2i} \) is

\[
R_i \equiv \max_{\alpha_{2i}} \tilde{B}(\alpha_{2i}) - c(\alpha_{2i}; \alpha_{1i}),
\]

where \( \tilde{B}(\alpha_{2i}) \) is given by condition (8).

Since agents with \( \alpha_i > e^{z+1} \) earn the same income as \( \alpha_i = e^{z+1} \) but incur larger investing costs, all agents in the second generation onwards must have \( \alpha_i \leq e^{z+1} \). The optimal solution and comparative statics are in the following lemma for the case \( a < \frac{1}{z+1} \) (the proof is in the appendix). The results when \( a \geq \frac{1}{z+1} \) holds are qualitatively similar, which are proved and summarized in proposition (9) in the appendix.

**Lemma 1** When \( a < \frac{1}{z+1} \) holds, the unique optimal solution is

\[
\alpha_{2i}^* \equiv g(\alpha_{1i}) = e^{z+1} - [\gamma(1 + \alpha_{1i})^{-\frac{a}{\omega k}}]^{z+1},
\]

where

\[
\gamma \equiv \frac{(z+1)ca}{\omega k}^\frac{1}{\omega k}.
\]

It is strictly increasing and concave in \( \alpha_{1i} \). It also increases in monitoring cost \( k \).

2.2.2 The Steady State

Since \( g() \) is strictly increasing and concave in the compact set \([0, A]\), the pair of father and son with identical cooperative tendency \( \alpha_c \) is uniquely determined by

\[
\alpha_c = g(\alpha_c).
\]

Actually if \( \tilde{B}(\alpha_i) \) does not change over time, \( \alpha_c \) is also the unique steady state cooperative tendency in society after \( n \) generations, where \( n \) is the number of generations for a family with \( \alpha_{1i} = 0 \) to

\[
\text{10 When there is a fixed cost of investing in cooperative tendency, it is possible that some parents with lower cooperative tendencies may not invest in their children. This will become clear in the next section.}
\]
achieve $\alpha_{ni} = \alpha_c$.\footnote{Here we implicitly assume that it takes fewer generations for the family with the highest cooperative tendency $\alpha_1 = A$ to reach the steady state $\alpha_c$. It does not matter if it is the other way around.} The evolving process is illustrated in figure 2. In the 2nd generation the lowest cooperative tendency

$$\alpha_2 \equiv g(\alpha_{n1} = 0) = e^{z+1} - \gamma^{z+1} > 0$$

is positive when $e \geq \gamma$ holds, while the highest one is $\bar{\alpha}_2 \equiv g(\alpha_{n1} = A) < e^{z+1} < A$ (though it approaches $e^{z+1}$ when $A$ is positive infinite). So the support of cooperative tendency shrinks from $[0, A]$ to $[\alpha_2, \bar{\alpha}_2]$ after one generation, and it becomes more concentrated over time until degenerating to the single level $\alpha_c$.

During this transition process, is it possible for principals to earn higher profits? For example, in the second generation the lowest cooperative tendency $\alpha_2$ is positive. Our previous arguments suggest that principals can get extra profits exploitative by reducing agents’ sign-in bonus of the amount $B(\alpha_2)$. If this is true, the bottom agents would get zero bonus and lower wage $w^*(\alpha_2) < w^*$ than their fathers, which cannot be an equilibrium. So either that principals stick to the fair bonus system $\tilde{B}(\alpha_i)$, or the bottom agents would always remain with zero cooperative tendency. In both cases, principals cannot earn more than $Q^*$ in the long run. For simplicity, we assume the former scenario is true where $\tilde{B}(\alpha_i)$ is always observed. So in the steady state the incentive package $(w^*_c, m^*_c)$ and bonus $B^*_c$ are determined respectively by conditions (3), (4), and (7) where $\alpha_i = \alpha_c$. Principals always earn the same profit $Q^*$, both during the transition periods and in the steady state.

**Proposition 2** The cooperative tendency evolves across generation according to the transition function $\alpha^*_{(n+1)i} = g(\alpha_{ni})$ in (10). The range of cooperative tendencies shrinks overtime until it degenerates to the unique steady state $\alpha_c \in (0, e^{z+1})$. $\alpha_c$ increases in monitoring cost $k$. Principals always get the same profit $Q^*$ as when the hired agent is completely selfish.

### 2.2.3 Discussions

When cooperative tendencies are endogenously formed to maximize agent life-time utilities, they are higher when the monitoring cost $k$ is high or the cost of investing in cooperative tendency is low. Both costs tend to go down as time goes by even in the absence of intentional effort. The technical differences between cooperative tendency investment and monitoring, however, seem to favor the latter. “The establishment of moral rules ... comes about in part through a complex process of socialization, learning, and inoculation” for many years from one’s childhood onward (Shavell...
This process is sensitive to both individual characteristics and social/cultural features, and thus difficult to be standardized and improved upon. In contrast, monitoring technologies can be applied to various situations and last over many generations. As a natural result of this imbalanced knowledge accumulation process, social trust would decline over time and at the same time the economic governance intensity (measured by the monitoring level) would go up.

This pattern of relative effectiveness would continue at least in the near future unless gene technologies sharply cut the investing cost of cooperative tendencies, or new activities difficult to monitor arise more quickly than technologies can handle.\textsuperscript{12} In the earlier history of human society, however, the opposite trend can be true since technologies changed so slowly that the monitoring cost remained almost the same for hundreds of years, while on the other hand stable communities helped reduce the cost of bringing up cooperative children. So the trajectories of social trust and economic governance are affected by the exogenous movements of the relative costs of monitoring and investing in cooperative tendencies.

To the extent that knowledge accumulation and technological advancement are mainly driven by intentional effort of optimizing individuals, the incentive structure in cost reduction may be much more important than the technical features described above. A key insight generated by our basic\textsuperscript{12}One example of the latter case may be the global terrorism that is extremely costly, if not possible, to monitor.
model is that principals have no incentives in improving social trust but strong incentives in reducing monitoring cost. Recall from the above proposition that principals always get the same profit $Q^*$ and are not able to capture any rent from cooperative tendencies. On the other hand, $Q^*$ can be increased by reducing monitoring cost $k$ (for example, through finding more efficient monitoring methods or advanced technology in transportation and communication). If principals control more resources in society than agents, monitoring costs are likely to be reduced faster than investment costs of cooperative tendency. Again social trust would decline over time and economic governance intensity would go up, which seems broadly consistent with the recent history.

The different ways of handling moral hazard problems in two traders group discussed by Greif (1994) can be used to test our results. In the late medieval period “the Maghribis and the Genoese faced a similar environment, employed comparable naval technology, and traded in similar goods.” The Maghribi traders (from the Muslim world) typically acted both as principals and agents simultaneously, while the Genoese traders (from the Latin world) seldom acted as agents themselves. Given this different social structure, our model suggests that the Maghribi traders would have more incentives in improving cooperative tendencies and less incentives in reducing monitoring costs. The reason is straightforward: All Maghribi traders, who acted as agents themselves, were able to share the rents from higher cooperative tendencies. The Genoese traders, however, acted only as principals and thus did not benefit from agents being more cooperative. This prediction is indeed supported by historical evidence where the Maghribi traders adopted the view that community members shared the fundamental duty to practice good and to ensure that others do not practice sin, maintained close social ties so that the costs of training and screening trustworthy agents were greatly reduced, paid lower efficiency wages to agents, and did not use available technologies to reduce monitoring costs. The Genoese traders paid higher efficiency wages to agents and were very keen on adopting new technologies and setting up new institutions to reduce monitoring costs. Their reliance on monitoring rather than individual mores also made the Genoese society more open to outsiders and helped them expanding international trade faster than the Maghribi traders. Our model suggests that the basic incentive structures in society lead to distinct institutional structures and path dependence, which is an alternative interpretation to the cultural belief version argued by Greif (1994).13

13 The story proposed here is not the contrast between individualist and collectivist per se, but the contrast between investing in individuals/mores and investing in impersonal institutions/governance (whether it be economic, legal, or political governance).
3 Multiple Projects with Different Monitoring Costs

In this section we study an extension to the basic model. Suppose principals have multiple projects which have different monitoring costs \( k_j, j = 1, 2, ..., J \), where \( k_1 < k_2 < ... < k_J \). The proportion of principals with project \( k_j \) is \( \rho_j \) such that \( \sum_{j=1}^J \rho_j = 1 \). There is no screening cost.

Fix a project, a principal’s optimization problem is the same as before. So the optimal wage and monitoring level are also determined by (3) and (4). The competition among principals again would drive their profits down to the lowest level in the same project. The multiple projects, however, induces across-project competition among agents. Agents strictly prefer projects with higher monitoring costs since the maximum income an agent can get increases in the monitoring cost of a project. And as would be shown in the following, principals also prefer agents with higher cooperative tendencies. So in equilibrium there is positive sorting where more cooperative agents work for projects with higher monitoring costs.

Project \( k_1 \) has the lowest monitor cost so it can only attract agents with lowest cooperative tendencies in the whole population. Since the mass of project \( k_1 \) is \( \rho_1 \), the proportion of agents working for it must also be \( \rho_1 \) in equilibrium. These two conditions imply \( \rho_1 = F(\alpha_{k_1}) \), where \( \alpha_{k_1} \) denotes the highest cooperative tendency of agents in project \( k_1 \). The least cooperative agent working for it is of course complete selfish. So the situation for project \( k_1 \) is exactly the same as the one project case before, where principals get profit \( Q^*(k_1) \) by condition (6) and offer sign-in bonus \( B(\alpha_i, k_1) \) by (7) to an agent with \( \alpha_i \in [0, \alpha_{k_1}] \).

Principals having project \( k_2 \), however, can take advantage of agent competition and offer a lower sign-in bonus than in the one-project case. Consider an agent with \( \alpha_{k_1} \). If project \( k_2 \) is the only project for all principals, the agent would earn income \( I(\alpha_{k_1}, k_2) \). But now with multiple projects, his best alternative income is \( I(\alpha_{k_1}, k_1) \) when he works for project \( k_1 \). So a principal with project \( k_2 \) needs to pay him only \( I(\alpha_{k_1}, k_1) \) and keeps the residual \( I(\alpha_{k_1}, k_2) - I(\alpha_{k_1}, k_1) \equiv r_2 \) where

\[
r_2 = \omega(k_2 - k_1)(1 + z^{-1})e - z^{-1}(e^{z+1} - \alpha_{k_1})\frac{1}{z}.\]

This leaves the agent with a lower sign-in bonus \( B_m(\alpha_i, k_2) \equiv B(\alpha_i, k_2) - r_2 \). Note \( r_2 \) is part of the rent generated by cooperative tendency, which increases in \( \alpha_{k_1} \). The principal, earning a profit \( Q^m_2 = Q^*(k_2) + r_2 \), gains from a higher \( \alpha_{k_1} \). Actually \( Q^m_2 \) is the profit got by all principals having project \( k_2 \) due to within-project competition among principals. Agent working for project \( k_2 \) must have \( \alpha_i \in [\alpha_{k_1}, \alpha_{k_2}] \) where \( \alpha_{k_2} \) is determined by \( \rho_1 + \rho_2 = F(\alpha_{k_2}) \). The same arguments are true for
other projects as well, where the results are summarized in the following proposition.

**Proposition 3** In equilibrium an agent with \( \alpha_i \in [\alpha_{k_j}, \alpha_{k_j+1}] \) works for project \( j+1 \) where \( \alpha_{k_j} \) is determined by

\[
F(\alpha_{k_j}) = \sum_{v=1}^{j} \rho_v
\]

and \( \alpha_{k_0} = 0 \). He gets a sign-in bonus \( B^m(\alpha_i, k_{j+1}) = B(\alpha_i, k_{j+1}) - r_{j+1} \), while his principal gets profit

\[
Q^*_{j+1} = Q^*(k_{j+1}) + r_{j+1},
\]

where

\[
\tau_{j+1} \equiv I(\alpha_{k_j}, k_{j+1}) - I(\alpha_{k_j}, k_j) = \omega(k_{j+1} - k_j)[(1 + z^{-1})e - z^{-1}(e^{z+1} - \alpha_{k_j})z^{j+1}]
\]

for \( j \geq 1 \) and \( r_1 = 0 \). \( r_{j+1} \) is the rent captured by principals, which increases in \( \alpha_{k_j} \) and the gap of monitoring cost \( k_{j+1} - k_j \).

When cooperative tendencies are endogenous, the net benefit for an agent/parent with \( \alpha_{2i} \) investing in \( \alpha_{2i} \) for his child (who will later work for project \( k_j \)) is

\[
R_{ij} \equiv \max_{\alpha_{2i}} \tilde{B}^m(\alpha_{2i}, k_j) - c(\alpha_{2i}; \alpha_{1i}),
\]

where \( \tilde{B}^m(\alpha_{2i}, k_j) = B(\alpha_{2i}, k_j) - r_j + w^*(\alpha_{2i}, k_j) - w^*(0, k_1) \) as in (8). It strictly increases in \( k_j \), which implies that all agents prefer their children to work for projects with higher monitoring costs. In equilibrium, however, only those with lower investing costs (i.e. higher parental cooperative tendency \( \alpha_{1i} \)) succeed. So in this economy with perfect social heredity, descendants of an agent would work for the same project across generations and no one ever climbs up the project ladder.14 This is as if each family is faced with only one project. So the same arguments in the one project case apply here, and in the steady state there are \( J \) different levels of cooperative tendencies \( \alpha_{cj} \) where \( \alpha_{cj} < \alpha_{cj+1} \). This is summarized in the following proposition and illustrated in figure (3).

**Proposition 4** Agents of the same family work for the same project for all generations. In the steady state there are \( J \) different levels of cooperative tendencies \( \alpha_{cj} \) where \( \alpha_{cj} < \alpha_{cj+1} \).

---

14Daniel L. McFadden in his autobiography describes an example of this sort. At MIT He was given a chair in the name of James Killian, the revered former president of MIT whose grandfather had owned the cotton mill in which McFadden’s grandfather was the chief mechanic. Bob Solow commented, “So much for social mobility in America; after two generations, you are still a mechanic in Killian’s mill.”
In this multiple project economy different monitoring costs enable principals to share the rent of cooperative tendency with agents, which leads to an incentive structure different from the one-project case. The following lemma summarizes the properties of profit function $Q_{j+1}^{m*}$ (proof in appendix).

**Lemma 2** Profit $Q_{j+1}^{m*}$ decreases in monitoring cost $k_{j+1}$ while increases in $\alpha_{k_j}$. The marginal gain from monitoring cost reduction, however, is not only lower than the one project case, but also decreases in $\alpha_{k_j}$. The marginal gain from $\alpha_{k_j}$ increases in $k_{j+1}$.

So principals with higher monitoring costs have less incentives in reducing monitoring costs and more in improving cooperative tendencies for agents. This may account for why some firms are willing to offer scholarships or other subsidies to schools and communities. But principals with the same project are linked by a public good $\alpha_{k_j}$, the lowest cooperative tendency among their agents. So the subsidy in cooperative tendency inoculation is subject to free riding problems typical in public goods provision, and is usually not socially optimal. Agents would not make socially efficient investment in cooperative tendencies either, since they do not get the full rent.

But the transitory nature of the rent captured by principals is still true. As the gap of monitoring costs between projects shrinks, the rent decreases and may disappear at the limit. The profit gain from monitoring cost reduction, however, belongs firmly to principals. So even though principals
may be able to share the rent of cooperative tendency in some occasions, it is easy to be drained away by competition and other forces (see the discussion below on screening).

4 Costly Screening

This section studies another extension to the basic model where a principal has to pay a positive screening cost in order to observe an agent’s cooperative tendency. Examples of screening include paying credit bureaus or headhunters to get one’s past history, requesting reference letters and qualification credentials, and conducting thorough interviews and tests. Better screening incurs a higher cost, but it allows principals to adopt a better fit incentive package and hence reducing governance costs. Since all principals are identical, they must earn the same profit independent of screening choice. This would lead to a positive sorting in equilibrium where principals spending more on screening are matched with agents with higher cooperative tendencies. And imperfect screening implies some agents have to pool together and receive identical incentive package, even though they behave differently.

4.1 The Stage Game with Screening

In the following we focus on a simple screening scheme where there are only two choices: incurring a fixed screening cost $s$ to accurately observe a cooperative tendency, or paying nothing and no information is revealed.\(^\text{15}\) Since the screening cost $s$ is the same regardless of the true $\alpha_i$ while the potential profit strictly increases in $\alpha_i$, there must exist a minimum cooperative tendency $\alpha$ such that only agents with $\alpha_i \geq \alpha$ are hired after being screened. Given this hiring criterion, agents with $\alpha_i < \alpha$ would not bother to be screened since they would be rejected anyway. Therefore a principal who does not screen must get these less cooperative agents. Note that if screening is ever used then $\alpha < e^{z+1}$ must be true since agents with $\alpha_i \in [e^{z+1}, A]$ behave identically in this environment. We thus assume $\alpha < e^{z+1}$ holds.

4.1.1 Pooling

Non-screening principals must choose the same wage $w_r$ and monitoring level $m_r$ since all pooling agents look the same to them. Given this incentive menu, agents with $\alpha_i \geq \alpha_r$ would make effort

\(^{15}\)Let’s consider a more general, continuous screening technology. Suppose the true cooperative tendency $\alpha_i$ is observed with some noise $\varepsilon$ so that a principal observes a signal $\tilde{\alpha}_i = \alpha_i + \varepsilon$. Assume $\varepsilon$ follow a normal distribution with mean zero and variance $\sigma^2(s)$, where $\sigma(s)$ decreases in screening cost $s$ and $\sigma(0) = A$. Then a principal spending screening cost $s$ would offer incentive package that is optimal to a pool of agents with $\alpha_i \in [\tilde{\alpha}_i - \sigma(s), \alpha_i]$. The analysis is essentially the same as pooling and sorting discussed in the paper, and thus would lead to similar qualitative results as using the simple screening method.
while others shirk, where
\[ \alpha_r \equiv e^{z+1} - w_r^* m_r \]
by non-shirking condition (1). So the probability that a pooling agent makes effort (hence producing \( hp \) on average) is
\[ \frac{F(\alpha_r) - F(\alpha_r)}{F(\alpha)} = 1 - \frac{\alpha_r}{\alpha} \]
under uniform distribution. The probability of shirking (and producing \(hq\) on average) is \( \frac{\alpha_r}{\alpha} \). So the principal’s expected profit is
\[ Q_r = (1 - \frac{\alpha_r}{\alpha})(hp - w_r) + \frac{\alpha_r}{\alpha}(hq - (1 - m_r)w_r) - m_r k^{z+1}. \]

Lemma 3 There exists a unique solution \((w_r^*, m_r^*)\) in maximizing profit \(Q_r\) for non-screening principals, where \( \frac{\partial m_r^*}{\partial \alpha} < 0, \frac{\partial w_r^*}{\partial \alpha} < 0, \frac{\partial Q_r^*}{\partial \alpha} > 0, Q_r^* > Q^* \).

This lemma (proof in the appendix) shows that both optimal wage \( w_r^* \) and monitoring level \( m_r^* \) decrease in \( \alpha \) – the highest cooperative tendency among pooling agents. So the optimal profit \( Q_r^* \) increases in \( \alpha \) and is higher than \( Q^* \) when screening is without cost. It is interesting to see that costly screening actually benefits principals by enabling them to share the rent generated by cooperative tendencies of pooling agents.

4.1.2 Screening

Since screening incurs a fixed lump-sum cost, the optimization problem of screening principals is exactly the same as in the zero cost case. So they would choose the same optimal incentive package \((w_r^*, m_r^*)\) as before for an agent with \( \alpha_i \in [\bar{\alpha}, A] \), though the maximal profit a principal can get is now \(Q_i^* - s\). But in an equilibrium where some principals screen agents while others not, all must earn the same profit \(Q_r^*\). And the difference between \(Q_i^* - s\) and \(Q_r^*\) is the sign-in bonus \(B_s(\alpha_i)\) for an agent with \( \alpha_i \in [\bar{\alpha}, A] \):
\[ B_s(\alpha_i) \equiv Q_i^* - s - Q_r^*. \]

Note that it is the screened agents that ultimately pay the screening cost \(s\). \(B_s(\alpha_i)\) can be rewritten as
\[ B_s(\alpha_i) = B(\alpha_i) - (Q_r^* - Q^*) - s \]
where \(B(\alpha_i) = Q_i^* - Q^*\) as defined by (7) is the bonus under zero screening cost. Note that \(B_s(\alpha_i) < B(\alpha_i)\) holds not only because agents have to pay the screening cost \(s\), but also that the alternative profit \(Q_r^*\) is higher.
The total income of an agent with $\alpha_i \geq \hat{\alpha}$ is $I_s(\alpha_i) = B_s(\alpha_i) + w^*_i$, and
\[
\tilde{B}_s(\alpha_i) \equiv B_s(\alpha_i) + w^*_i - w^*_r
\]
is the extra income than the wage $w^*_r$ got by a pooling agent.\textsuperscript{16} To make the marginal agent $\hat{\alpha}$ indifferent between pooling with others and being screened,
\[
\tilde{B}_s(\hat{\alpha}) = 0
\]
must hold. $\hat{\alpha}$ is uniquely determined by this condition, which increases in $s$ and decreases in $k$ (the proof is in the appendix). The following proposition summarizes the results we’ve got so far.

**Proposition 5** When the screening cost $s$ is positive, there exists a unique cooperative tendency $\hat{\alpha}$ where agents with $\alpha_i \in [0, \hat{\alpha}]$ pool together and those with $\alpha_i \in [\hat{\alpha}, A]$ are screened. The threshold $\hat{\alpha}$ increases in screening cost $s$ and decreases in monitoring cost $k$. It is the screened agents who pay the screening cost $s$. All principals, however, get a higher profit $Q^*_f > Q^*$.

### 4.2 Across-Generation Dynamics with Screening

Since pooling agents get the same wage regardless of individual cooperative tendencies, there is no gain of acquiring any positive cooperative tendency lower than the threshold level worthwhile to be screened. This implies that after the first generation any agents not screened must have zero cooperative tendency. Knowing this, the non-screening principals would offer the incentive package $(w^*, m^*)$ and get profit $Q^*$. So pooling unravels after one generation. Since in equilibrium screening principals must also get profit $Q^*$, the rent $Q^*_f - Q^*$ once captured by principals has to be passed on to screened agents. So from the second generation onwards principals cannot get any rent from agent cooperative tendencies.

**Proposition 6** When cooperative tendencies are endogenously formed to maximize one’s welfare, pooling unravels and principals cannot capture any rent for more than one generation. All principals get the same profit $Q^*$ as when there is no screening cost.

Since for generations $n \geq 2$ all principals get profit $Q^*$ and bottom agents earn income $w^*$, the gross return of cooperative tendency investment is the same as before. The net return $R_{si}$ is lower

\textsuperscript{16}The $\tilde{B}_s(\alpha_i)$ differs from its counterpart $\bar{B}(\alpha_i) \equiv B(\alpha_i) + w^*_i - w^*_r$ under zero screening cost by three channels: the principals now earn a higher profit $Q^*_f \geq Q^*$, the alternative wage is lower since $w^*_i \leq w^*$, and finally a positive screening cost $s$ has to be paid. Since the highest bonus an agent can earn is $z^{-1}\omega ke$, the necessary condition $s < z^{-1}\omega ke$ must be satisfied to have a positive mass of screened agents.
due to the positive screening cost:

\[ R_{si} = \max_{\alpha_{2i}} \tilde{B}(\alpha_{2i}) - c(\alpha_{2i}; \alpha_{1i}) - s. \] (16)

The objective function for parents investing in \( \alpha_{2i} \) is

\[ \max \{ R_{si}, 0 \} \]

where 0 is achieved by not investing. Since the screening cost \( s \) acts like a fixed cost, the optimal choice \( \alpha^*_{2i} \) is the same as in

(10) when \( R_{si} \geq 0 \).

Let \( \tilde{\alpha}_2 \) be the threshold level of cooperative tendency such that \( R_{si}(\tilde{\alpha}_2) = 0 \). Let \( \underline{\alpha}_1 \) denote the lowest cooperative tendency among the first generation agents who invest in child cooperative tendencies. Then it must be uniquely determined by \( \tilde{\alpha}_2 = g(\underline{\alpha}_1) \) since \( \alpha_{2i} = g(\alpha_{1i}) \) in (10) strictly increases in \( \alpha_{1i} \). The net return of investing in \( \alpha_{2i} > 0 \) is negative for families with \( \alpha_{1i} < \underline{\alpha}_1 \), so their descendents have zero cooperative tendency starting from the 2nd generation.\(^{17}\)

For families with \( \alpha_{1i} \geq \underline{\alpha}_1 \) the evolution path is the truncated \( g(\alpha) \) with \( \alpha_{1i} \in [\underline{\alpha}_1, A] \), where the steady state level cooperative tendency is again \( \alpha_c \) if \( \tilde{\alpha}_2 \leq \alpha_c \), or \( \tilde{\alpha}_2 \) if \( \tilde{\alpha}_2 > \alpha_c \). The mass of cooperative agents from the second generation onwards is thus equal to

\[ \pi(s, k) \equiv 1 - F(\underline{\alpha}_1). \]

From proposition (5) we know \( \underline{\alpha}_1 \) must also increase in screening cost \( s \) and decrease in monitoring cost \( k \). It follows immediately that \( \partial \pi(s, k)/\partial s < 0 \) and \( \partial \pi(s, k)/\partial k > 0 \). That is, more agents would acquire positive cooperative tendencies when screening cost is lower or monitoring is more costly. Thus we have proved the following proposition.

**Proposition 7** When the screening cost is positive, the across generation evolution of cooperative tendency is composed of two parts: For families with \( \alpha_{1i} \geq \underline{\alpha}_1 \) it is the same as with zero screening cost; agents from families with \( \alpha_{1i} < \underline{\alpha}_1 \) have zero cooperative tendency starting from the second generation. So in the steady state there are two groups of agents, \( \pi(s, k) \) of them are cooperative with \( \alpha_c \) while the others completely selfish. Both the level of cooperative tendency \( \alpha_c \) and the mass of cooperative agents \( \pi(s, k) \) increase in monitoring cost \( k \), while \( \pi(s, k) \) also decreases in screening cost \( s \).

This proposition implies that in the long run social trust in society is higher if screening cost \( s \) is lower and/or monitoring cost \( k \) is higher. The result is consistent with the empirical evidence that

\(^{17}\)When families maximize over many generations things may be different. For example, they may incur some loss in the first few generations to invest in positive cooperative tendencies. This possibility is eliminated if families cannot borrow against future.
trust is higher in more homogenous communities (Alesina and La Ferrara 2002) since screening costs are lower among people with similar backgrounds. Since the screening cost is paid by agents and all principals still earn the same profit $Q^*$ as before, principals have no incentives to reduce either screening or cooperative tendency investment costs. So the incentive structure on cost reduction is the same as in the basic model.\textsuperscript{18}

The technical characteristics of screening cost are affected by many things. For example, information technologies make it easier to record one’s past behaviors and thus tend to reduce $s$, but higher mobility and globalization work in the opposite direction. Overall screening costs are more individual-specific and thus less robust to agent identity changes than monitoring costs. So for both incentive and technical reasons the monitoring cost tends to decrease faster than the screening cost, which again leads to the decline of social trust over time. The opposite trend can be true in places or times when technology changes very slowly and communities are stable for many years so that the screening efficiency increases faster.

5 The Evolving of Social Trust and Economic Governance

In the steady state, both social trust and economic governance are determined by fundamental forces in society such as the costs of screening, monitoring, and investing in agents. All these costs tend to decrease overtime as a result of knowledge accumulation, albeit at unequal reduction rates due to different incentive structure and technical features. With some reasonable assumptions about cost reduction rates, the theory developed above can be used to make sharp predictions about the long-term evolving process of social trust and economic governance over time and across societies.

For simplicity we normalize the changing rate of cooperative tendency inoculation costs to zero and focus on the relative movement of monitoring and screening costs. We also ignore the technical differences between the two types of costs in order to concentrate on the effects of their different incentive structures. The reduced form analysis is adopted where we assume the cost reduction rates are higher if the associated aggregate benefits are larger.

\textsuperscript{18}When the screening cost is positive in the multiple project situation, agents in equilibrium pool within a project but not across projects, and pay bonds to principals with higher monitoring costs. On the other hand, the screening principals may share the screening cost with the agents since they capture partial rent from cooperative tendency. In the steady state there are still multiple levels of cooperative tendencies. The detailed analysis is omitted since both the arguments and results are similar as the case with zero screening cost.
5.1 Trajectories Over Time

5.1.1 Monitoring Cost Reduction Process

Since all principals get profit \( Q^* = hp - (1 + z^{-1})\omega ke \), the aggregate marginal benefit of reducing monitoring cost \( k \) is
\[
|\frac{\partial Q^*}{\partial k}| = (1 + z^{-1})\omega e
\]
for principals. Suppose the monitoring cost is reduced at rate \( \tau_{kt} \) in period \( t \) such that
\[
k_{t+1} = k_t(1 - \tau_{kt}).
\]
(18)

We assume \( \tau_{t} \) is positively related to the marginal benefit such that
\[
\tau_{kt} = \rho_k |\frac{\partial Q^*}{\partial k_t}| \equiv \tau_k
\]
for some \( \rho_k \geq 0 \), which is constant over time by (17). Since the aggregate agent income increases in \( k \), \( |\frac{\partial Q^*}{\partial k_t}| \) is larger than the aggregate marginal benefit for the whole society. This implies that the reduction rate \( \tau_k \) of monitoring cost is too high compared to the social optimal level.

Let \( \pi_t \equiv \pi(s_t, k_t) \) be the mass of cooperative agents in the steady state at period \( t \); \( (w^*_t, m^*_t) \) and \( (w^*_c, m^*_c) \) are the optimal incentive packages for selfish and cooperative agents respectively. Then the average governance cost \( M_t \) in a society is
\[
M_t \equiv \pi_t(w^*_c + m^*_ck^{z+1}_t) + (1 - \pi_t)(w^*_t + m^*_tk^{z+1}_t).
\]
The economic governance intensity in a society is measured by the ratio \( M_t/(w^*_t + m^*_tk^{z+1}_t) \). Plugging in the specific functions in (3) and (4) we get
\[
\frac{M_t}{w^*_t + m^*_tk^{z+1}_t} = 1 - \pi_t[1 - \left(1 - \frac{\alpha_c}{e^{z+1}}\right)\frac{1}{\frac{1}{\tau_k}}]
\]
So the economic governance intensity in a society decreases in both \( \pi_t \) and \( \alpha_c \), while by definition social trust increases in both.

When screening cost keeps constant, in the next period we would have a lower monitoring cost \( k_{t+1} < k_t \). This leads to a smaller \( \pi_{t+1} < \pi_t \) and a lower cooperative tendency \( \alpha_{c,t+1} < \alpha_{c,t} \) since both of them decrease in \( k_{t+1} \). And this downward process would continue where social trust keeps decreasing while economic governance intensity keeps increasing as long as the monitoring cost can be further reduced.
5.1.2 Screening Cost Reduction Process

Recall that only screened agents benefit from a lower screening cost, and each of them has the same marginal benefit equal to one by condition (14). So the aggregate marginal benefit from reducing screening cost is $\pi_t$ at period $t$, where $\pi_t \equiv \pi(s_t, k_t)$ is the mass of cooperative agents in the steady state at period $t$. We assume the reduction rate of screening cost $\tau_{st}$ increases in $\pi_t$ such that

$$\tau_{st} = \rho_s \pi_t$$

for some $\rho_s \geq 0$, and

$$s_{t+1} = s_t (1 - \tau_{st}).$$ (19)

When the monitoring cost is constant, the next period screening cost $s_{t+1} < s_t$ is lower. This would encourage more agents to become cooperative, which leads to $\pi_{t+1} > \pi_t$ given $\pi_s(s,k) < 0$. And this would lead to further decreasing of screening cost since $\tau_{st+1} > \tau_{st}$ and further increasing of the mass of cooperative agents. So social trust keeps increasing while economic governance intensity keeps decreasing as long as the screening cost can be reduced.

5.1.3 The Joint Process

The actual relationship between social trust and economic governance is determined simultaneously by these two counteracting forces. If the relationship between monitoring cost reduction rate $\tau_k$ and screening cost reduction rate $\tau_{st}$ in period $t$ leads to $\pi_{t+1} < \pi_t$, then in the next period there would be less incentives in reducing the screening cost so that $\tau_{st+1} < \tau_{st}$ holds. But this means the same relationship between $\tau_k$ and $\tau_{st}$ is strengthened over time so that the decrease of monitoring cost would again dominates that of screening cost. So the downward trend of social trust, once started, would not stop or reverse the direction by itself. If the opposite is true in period $t$, that is, if the screening cost reduction is strong enough to increase $\pi_{t+1} > \pi_t$, then this dominant relationship is also reinforced over time. Again, the upward movement of social trust would continue without stop. So if there are some exogenous shocks significant enough to change the direction for one period, the whole history would then embark on a totally different course thereafter. Otherwise, it is very difficult for the society itself to change direction or adopt successful institutions.
5.2 Trajectories Across Societies

Let’s consider two otherwise identical social groups where the only difference is that one group has a slightly lower screening cost.\(^\text{19}\) Let \(s_{L0}\) and \(s_{H0}\) denote the initial screening costs of the two groups where \(s_{L0} < s_{H0}\). The initial monitoring cost is \(k_0\) for both groups. And they have access to the same set of technologies that can be used to reduce both monitoring and screening costs. The following analysis can be used to account for differences of the two trader groups discussed by Greif (1994).

In the steady state the level of cooperative tendency \(\alpha_c\) is independent of screening costs so that \(\alpha_{L0} = \alpha_{H0} = \alpha_c0\). The mass of cooperative agents \(\pi(s, k)\) decreases in \(s\) so we have \(\pi_{L0} > \pi_{H0}\), where \(\pi_{L0} \equiv \pi(s_{L0}, k_0)\) and \(\pi_{H0} \equiv \pi(s_{H0}, k_0)\). This implies that there are higher initial social trust in \(L\) group than in \(H\) group, caused by a small difference in screening cost only.

Given \(\pi_{L0} > \pi_{H0}\), the screening cost decreases faster in \(L\) group so that \(s_{L1} < s_{H1}\) is still true. So the relative strength between social trust and economic governance is preserved or even strengthened over time for these two groups, no matter what time trajectories they are on. For example, if \(\pi_{L1} < \pi_{L0}\) and \(\pi_{H1} < \pi_{H0}\) hold, by the above arguments we know the screening costs would be reduced at decreasing rates in both societies where the rate in \(H\) group is even lower. A second possible scenario is when \(\pi_{L1} > \pi_{L0}\) and \(\pi_{H1} > \pi_{H0}\) hold. Then the screening cost is reduced at increasing rates where the reduction is faster in \(L\) group. A third scenario is when \(\pi_{L1} > \pi_{L0} > \pi_{H0} > \pi_{H1}\) holds. That is, the two groups are heading into opposite directions where \(L\) group sees rising social trust and declining monitoring. And the gap of social trust and economic governance between the two groups also increases. In this case, a small initial difference may eventually lead to two extreme situations.

**Proposition 8** Both downward and upward movement of social trust and economic governance, once started, would continue monotonically. Their relative strength across societies is preserved or reinforced over time, where social trust is always lower and economic governance level is always higher in a society with a higher screening cost initially.

The two societies also react differently to exogenous shocks. Suppose the two groups have opportunities to expand business by hiring agents from a third group. The high across-group screening cost
\(^{19}\) For example, people living in plain mainland areas are more likely to become similar to each other than those spread across different islands or highlands. If similar backgrounds help reduce screening cost, then mainland society would have a lower screening cost.
cost is less an obstacle for principals from the low trust group since they do not rely much on screening. So they are more open to outsiders and would expand inter-group trading faster than the high trust group (Greif 1994).

6 Conclusions

This paper studies the dynamic relationship between social trust and economic governance in a context of principal-agent problem. The optimal incentive packages are determined by the existing cooperative tendencies of agents, while in the long run both are functions of fundamental forces in the economy such as the costs of monitoring and screening agents and the investment cost in cooperative tendencies. Principals have incentives in reducing the monitoring costs but not in reducing screening and investing costs. The technical features of these three costs also favor the monitoring technology which is easier to be standardized and more robust to changes. Our model thus is able to account for the decline of social trust and increase of economic governance in the recent history, and also the comparison between groups with different initial social trust levels.

The model can be extended in various ways. For example, there may be instant feedback effects from economic governance modes to agent cooperative tendencies in addition to the fixed dispositions discussed in the paper. Some recent works in this line include Kreps (1997), Rob and Zemsky (2002), and Akerlof and Kranton (2003) among others. The screening process can be endogenized through repeated interactions among players, which may be used to study the dynamic interplay between informal enforcement and formal institutions. A third extension is to add cognitive ability besides cooperative tendency, which may give rise to results on changes of human capital components over time.
References


Appendix

1. The proof for Lemma 1.

Lemma 1: When \( a < \frac{1}{z+1} \) holds, the unique optimal solution is
\[
\alpha_{2i}^* \equiv g(\alpha_{1i}) = e^{z+1} - [\gamma(1 + \alpha_{1i})^{-\frac{b}{a(z+1)}}]^{-1},
\]
where \( \gamma \equiv \left(\frac{z(z+1)a}{\omega k}\right)^{-\frac{1}{a(z+1)}} \). It is concave in \( \alpha_{1i} \) and increasing in monitoring cost \( k \).

Proof. The objective function is
\[
R_i \equiv \max_{\alpha_{2i}} \bar{B}(\alpha_{2i}) - c(\alpha_{2i}; \alpha_{1i}) = z^{-1} \omega k(e - (e^{z+1} - \alpha_{2i})^{-\frac{1}{a(z+1)}}) - \frac{c[e(z+1)^a - (e^{z+1} - \alpha_{2i})^a]}{(1 + \alpha_{1i})^b}.
\]
The first order condition is
\[
\frac{\omega k}{z(z+1)(e^{z+1} - \alpha_{2i})^{-\frac{1}{a(z+1)}}} - \frac{ca}{(1 + \alpha_{1i})^b} = 0.
\]
The second order condition
\[
-(\frac{1}{z+1} - a) \frac{\omega k}{z(z+1)}(e^{z+1} - \alpha_{2i})^{-\frac{1}{a(z+1)}} < 0
\]
is satisfied when
\[
a < \frac{1}{z+1},
\]
which is assumed true.

From condition (21) we get the unique optimal choice
\[
\alpha_{2i}^* \equiv g(\alpha_{1i}) = e^{z+1} - [\gamma(1 + \alpha_{1i})^{-\frac{b}{a(z+1)}}]^{-1},
\]
where
\[
\gamma \equiv \left(\frac{z(z+1)a}{\omega k}\right)^{-\frac{1}{a(z+1)}}.
\]
Since \( \frac{\partial \alpha_{2i}^*}{\partial \gamma} = \frac{\partial \alpha_{2i}^*}{\partial k} \frac{\partial k}{\partial \gamma} \) and
\[
\frac{\partial \alpha_{2i}^*}{\partial \gamma} = -\left(1 + \alpha_{1i}\right)^{-\frac{b}{a(z+1)}}(z+1)\gamma^z < 0,
\]
\[
\frac{\partial \gamma}{\partial k} = \left(\frac{z+1}{\omega}\right)^{-\frac{1}{a(z+1)}} \frac{-1}{1 - a(z+1)\frac{1}{k^{-\frac{1}{a(z+1)}}}} < 0,
\]
it follows that \( \frac{\partial \alpha_{2i}^*}{\partial k} > 0 \). \( \alpha_{2i}^* \) increases in \( \alpha_{1i} \) and is concave in it because the following conditions
\[
\frac{\partial \alpha_{2i}^*}{\partial \alpha_{1i}} = \frac{b(z+1)\gamma^{z+1}}{1 - a(z+1)(1 + \alpha_{1i})^{-\frac{b(z+1)}{a(z+1)}}} > 0,
\]
\[
\frac{\partial^2 \alpha_{2i}^*}{\partial \alpha_{1i}^2} = \frac{-b(z+1)\gamma^{z+1}}{1 - a(z+1)\left(\frac{b(z+1)}{1 - a(z+1)} + 1\right)(1 + \alpha_{1i})^{-\frac{b(z+1)}{a(z+1)}}-2} < 0.
\]

28
are satisfied. ■

2. The proof for Lemma 2.

Lemma 2: Principals of project \(k_{j+1}\) get profit \(Q_{j+1}^{m^*}\) for \(j \geq 1\) and those of project \(k_1\) get profit \(Q^*(k_1)\). \(Q_{j+1}^{m^*}\) decreases in monitoring costs \(k_{j+1}\) while increases in \(\alpha_{k_j}\). The marginal gain of monitoring cost reduction, however, is not only lower than the one project case, but also decreases in \(\alpha_{k_j}\). The marginal profit gain of \(\alpha_{k_j}\) increases in \(k_{j+1}\).

**Proof.** The profit \(Q_{j+1}^{m^*}\) is

\[
Q_{j+1}^{m^*} = Q^*(k_{j+1}) + r_{j+1}
= hp - \omega_{k_{j+1}}z^{-1}(e^{z+1} - \alpha_{k_j})^{z+1} - \omega_{k_j}z^{z+1}[\omega_{k_j}(1 + z)e - (e^{z+1} - \alpha_{k_j})^{z+1}].
\]

(23)

It decreases in monitoring costs \(k_{j+1}\) as before since

\[
\frac{\partial Q_{j+1}^{m^*}}{\partial k_{j+1}} = -\omega z^{-1}(e^{z+1} - \alpha_{k_j})^{z+1} < 0.
\]

The marginal gain of monitoring cost reduction \(\frac{\partial Q_{j+1}^{m^*}}{\partial k_{j+1}}\) is, however, lower than the one project case where

\[
\frac{\partial Q^*}{\partial k} = (1 + z^{-1})\omega ke.
\]

It becomes even lower when agents are more cooperative:

\[
\frac{\partial}{\partial \alpha_{k_j}} \frac{\partial Q_{j+1}^{m^*}}{\partial k_{j+1}} = -\frac{1}{z + 1} \omega z^{-1}(e^{z+1} - \alpha_{k_j})^{z+1} < 0.
\]

Furthermore, the profit increases in \(\alpha_{k_j}\) since

\[
\frac{\partial Q_{j+1}^{m^*}}{\partial \alpha_{k_j}} = \frac{1}{z(z + 1)} \omega(k_{j+1} - k_j)(e^{z+1} - \alpha_{k_j})^{z+1} > 0,
\]

and the increasing rate is higher for a higher \(k_{j+1}\) since

\[
\frac{\partial^2 Q_{j+1}^{m^*}}{\partial \alpha_{k_j} \partial k_{j+1}} = \frac{1}{z(z + 1)} \omega(e^{z+1} - \alpha_{k_j})^{z+1} > 0.
\]

Note \(\alpha_{k_j}\) is the lowest cooperative tendency of agents working for the same project. ■

3. The proof for Lemma 3.

Lemma 3: There exists a unique solution \((w^*_r, m^*_r)\) in maximizing \(Q_r\) where \(\frac{\partial m^*_r}{\partial \alpha} < 0, \frac{\partial w^*_r}{\partial \alpha} < 0, \frac{\partial Q^*_r}{\partial \alpha} > 0, Q^*_r > Q^*\).

**Proof.** The profit for non-screening principals can be rewritten as

\[
Q_r = hp - w_r - m_r k^{z+1} - \frac{e^{z+1} - w^*_r m_r}{\tilde{\alpha}}(k(p - q) - m_r w_r).
\]
The first order conditions to maximize $Q_r$ are, respectively,

$$w^*_r: Q_w = (e^{z+1} - w^*_r m_r)m_r + (h(p-q) - m_rw_r)zw^*_r - \hat{\alpha} = 0, \quad (24)$$

$$m^*_r: Q_m = (e^{z+1} - w^*_r m_r)m_r + (h(p-q) - m_rw_r)w^*_r = \hat{\alpha}k^{z+1}. \quad (25)$$

It is straightforward to check that zero monitoring and wage cannot be optimal, which means $\alpha_r < e^{z+1}$ always holds even when $\hat{\alpha} = A$.

The second derivatives are

$$Q_{ww} = -2zw^*_r - (h(p-q) - m_rw_r)(1-z)w^*_r - 2m_r < 0,$$

$$Q_{mm} = -2w^*_r < 0,$$

$$Q_{wm} = B = e^{z+1} - w^*_r m_r + (h(p-q) - w^*_r m_r)zw^*_r - (z+1)w^*_r m_r,$$

where $Q_{wm} = B > 0$ is assumed to be true due to the complementarity between wage and monitoring level. The second order condition is

$$Q_{mm}Q_{ww} - Q_{wm}^2 = -2w^*_r D - B^2 > 0,$$

which is assumed to be true.

The comparative statics wrt $\hat{\alpha}$ can be solved from

$$B \frac{\partial m^*_r}{\partial \hat{\alpha}} + D \frac{\partial w^*_r}{\partial \hat{\alpha}} = 1,$$

$$-2w^*_r \frac{\partial m^*_r}{\partial \hat{\alpha}} + B \frac{\partial w^*_r}{\partial \hat{\alpha}} = k^{z+1}.$$

After simple manipulation we have

$$\frac{\partial m^*_r}{\partial \hat{\alpha}} = (B^2 + 2w^*_r D)^{-1}(B - Dk^{z+1}) < 0,$$

$$\frac{\partial w^*_r}{\partial \hat{\alpha}} = (B^2 + 2w^*_r D)^{-1}(2w^*_r + Bk^{z+1}) < 0,$$

since $B > 0, D < 0,$ and $B^2 + 2w^*_r D < 0$ by the second order condition.

Not surprisingly, the principal’s profit increases with $\hat{\alpha}$:

$$\frac{\partial Q^*_r}{\partial \hat{\alpha}} = \frac{f(\hat{\alpha})F(e^2 - w^*_r m^*_r)}{F^2(\hat{\alpha})}(h(p-q) - w^*_r m^*_r) > 0.$$

Since $Q^*_r(\hat{\alpha} = 0) = Q^* = hp - (1 + z^{-1})\omega k e$, it is obvious that $Q^*_r > Q^*$. ■

4. Proof for proposition 5.
Proposition 5: When the screening cost $s$ is positive, (1) there exists a unique cooperative tendency $\hat{\alpha}$ where agents with $\alpha_i \in [0, \hat{\alpha}]$ pool together and those with $\alpha_i \in [\hat{\alpha}, A]$ choose to be screened. The threshold $\hat{\alpha}$ increases in screening cost $s$ and decreases in the monitoring cost $k$. (2) In comparison with the perfect information case, all principals get a higher profit $Q_r^*$, while screened agents receive a lower sign-in bonus $B_s(\hat{\alpha}_i)$ and the same incentive package $(w_r^*, m_r^*)$.

Proof. The income difference between a screened agent with a pooling one is

$$\tilde{B}_s(\alpha_i) \equiv B(\alpha_i) - (w_r^* - w_i^*) - (Q_r^* - Q_r^*) - s.$$

For the agent with the threshold cooperative tendency $\hat{\alpha}$ the extra income is

$$\tilde{B}_s(\hat{\alpha}) = Q_{co}^*(\hat{\alpha}) + w_{co}^*(\hat{\alpha}) - Q_r^*(\hat{\alpha}) - w_r^*(\hat{\alpha}) - s = 0. \quad (26)$$

Let’s check whether such defined $\hat{\alpha}$ is unique. The first derivative of $\tilde{B}_s(\hat{\alpha})$ with respect to $\hat{\alpha}$

$$\frac{\partial \tilde{B}_s(\hat{\alpha})}{\partial \hat{\alpha}} = \frac{\partial [Q_{co}^*(\hat{\alpha}) + w_{co}^*(\hat{\alpha})]}{\partial \hat{\alpha}} - \frac{\partial [Q_r^*(\hat{\alpha}) + w_r^*(\hat{\alpha})]}{\partial \hat{\alpha}} > 0$$

is positive since the first item measures the marginal total output gain of cooperative tendency in an unconstrained maximization which is larger than that in a constrained one measured by the second item. Intuitively the pooling principal, because of imperfect information, adopts a higher than necessary wage and monitoring level for agent with $\hat{\alpha}$, which is a waste of resources. For the same reason, we get

$$\frac{\partial \tilde{B}_s(\hat{\alpha})}{\partial k} = \frac{\partial [Q_{co}^*(\hat{\alpha}) + w_{co}^*(\hat{\alpha})]}{\partial k} - \frac{\partial [Q_r^*(\hat{\alpha}) + w_r^*(\hat{\alpha})]}{\partial k} > 0.$$

From the equation (26) we can get the comparative statics of the threshold cooperative tendency $\hat{\alpha}$ by implicit function theorem

$$\frac{\partial \hat{\alpha}}{\partial s} = -\frac{1}{\partial(\tilde{B}_s(\hat{\alpha}) + s)/\partial \hat{\alpha}} > 0,$$

$$\frac{\partial \hat{\alpha}}{\partial k} = \frac{\partial \tilde{B}_s(\hat{\alpha})}{\partial k}/\frac{\partial \tilde{B}_s(\hat{\alpha})}{\partial \hat{\alpha}} < 0.$$

So the threshold cooperative tendency $\hat{\alpha}$ increases with the screening cost $s$ and decreases with the monitoring cost $k$, which is quite intuitive. It implies that the proportion of principals who screen agents is lower when $s$ is larger or when $k$ is smaller. ■

5. Proof for proposition 9: the case for $a \in \left[ \frac{1}{1+z}, 1 \right]$.  

31
Proposition 9: Suppose \( a \geq \frac{1}{z+1} \) holds. (1) With no screening cost, the distribution of cooperative tendency degenerates to a single point \( e^{z+1} \) from the second generation onwards. Accordingly the incentive package is \((0, 0)\), agents’ bonus reaches the highest level \((1 + z^{-1})\omega ke\). The principals still earn the same profit \( Q^* \) as in the static environment. (2) With positive screening cost, the distribution of cooperative tendency degenerates into two points from the second generation onwards, where those with \( \alpha_{1i} \geq \alpha_1 \) have \( \alpha_{(n+1)i}^* = e^{z+1} \) and others 0. The mass of cooperative agents, \( 1 - F(\alpha_1) \), decreases in screening cost \( s \) and increase in monitoring cost \( k \).

Proof. When \( \frac{1}{z+1} \leq a < 1 \), the cost function is still convex but the second order condition fails. That is, the net benefit \( \tilde{B}(\alpha_{2i}) - c(\alpha_{2i}; \alpha_{1i}) \) is now convex in \( \alpha_{2i} \). So the optimal solution is either \( \alpha_{2i} = e^{z+1} \) or 0 depending on whether the net return is positive or not. Since the cost decreases in \( \alpha_{1i} \), it is helpful to check whether the parent with \( \alpha_{1i} = 0 \) wants to invest or not. The net return of such a parent

\[
R_0 = z^{-1}\omega ke - ce^{(z+1)a} \leq \alpha_1 = \frac{1}{z^{-1}\omega ke - s} > 0
\]

is positive since \( \gamma < e \) and \( a < \frac{1}{z+1} \). This implies all parents invest in \( e^{z+1} \) and from the second generation onwards the distribution of cooperative tendency degenerates into a single point \( e^{z+1} \). Since all agents are fully trustworthy, no incentive package is needed so that both monitoring and efficiency wage are zero. All agents earn the highest possible bonus \((1 + z^{-1})\omega ke\) and the social welfare reaches the maximum \( hp \), while principals are still earning the same profit \( Q^* \) as before.

When cooperative tendencies are endogenous the case of \( \frac{1}{z+1} \leq a < 1 \) is also similar in that agents whose net returns are larger or equal to the screening cost will invest in \( e^{z+1} \). Suppose agents with \( \alpha_{1i} \geq \alpha_1 \) will invest, where \( \alpha_1 \) is defined by the equation

\[
R_s = \tilde{B}(e^{z+1}) - c(e^{z+1}; \alpha_1) - s = 0.
\]

Plug in the functional forms we get

\[
\alpha_1 = \frac{ce^{(z+1)a} }{ z^{-1}\omega ke - s} - 1.
\]

It is easy to see that \( \alpha_1 \) increases in \( s \) and decreases in \( k \), which is the same as \( \alpha_1 \).