High-Powered Incentives and Communication Failure

ABSTRACT

This paper uses a donor-provider-agent framework to study the role of provider incentives for the delivery of developmental goods like aid, credit, or technology transfer to the poor. The paper considers a situation where credible communication by the provider is the key to successful delivery. The study shows that the use of high-powered incentives can lead to breakdown of communication between providers and agents, leading to undesirable outcomes. The paper studies the interplay between incentives and communication in the presence of typical and motivated providers and finds that in certain situations incentivization leads to worse outcomes.

Key Words: Incentives; Communication; Motivated Provider.

JEL Classification: D8; J3; O1; O3.

1 Introduction

Consider an agency situation where a donor (Principal) relies on a provider (Intermediary) to deliver certain goods and services to a group of clients (Agent). Various aspects of the delivery system have come under scrutiny in recent times. A key recurring theme that has been emphasized in the literature is the need to incentivize the providers or intermediaries responsible for delivery of goods and services.[1] For example, in the context of foreign aid, it has been pointed out that the intermediaries may not have the right kind of incentives to see that aid is spent effectively (Easterly and Pfutze (2008)). Likewise, in the context of microfinance, a major cause for concern is the issue of appropriate incentives for loan officers to achieve the organizational goals of the microfinance institutions (Armendariz de Aghion and Murdoch (2004)). The role of incentives in the context of government bureaucracy and delivery of various social services has also been a subject of investigation (Dixit (2002), Tirole (1994) and Wilson (1989)).

In many such agency settings, successful delivery and realization of benefits by the agents requires the provider to communicate relevant information, which the provider must acquire at some cost before it can communicate. The objective of our paper is to show that while it is possible to design an incentive scheme to induce the provider to acquire costly information, the incentive scheme can render the process of communication ineffective. Using a simple example of targeted technology transfer, we show how the use of high-powered incentives becomes counter-productive.

Consider for instance a farmer who is currently earning a fixed, deterministic income using traditional technology and is considering the adoption of modern technology with stochastic outcomes. Relative to the tra-

[1]Even though we use a three tiered sturcture, our focus is on the interaction between the provider and the agents. Makris (2009) studies a similar problem of incentives for intermediaries providing non-marketable goods. Unlike the agency structure used here, he focuses on a principal-agent framework.

ditional technology, modern technology can lead to higher as well as lower incomes. The chances of success depend on the characteristics (skill level) of the farmer, the nature of the technology, and the environment in which the farmer will operate it (state of nature).[2] It is possible that the farmer, though informed about his own characteristics, is unable to calculate the success probabilities because of lack of information about the state of nature. In such an event, even rational farmers may switch to the modern technology with lower expected incomes because they are uninformed about success probabilities.[3] The question then is how to provide them with this information in a credible manner.

In our setting, such information can be made available to the recipients of the modern technology by the provider, to whom the donor provides the funds for disbursement. It turns out that while providers can successfully communicate to the relevant agents in the absence of any incentives, the communication process breaks down in the presence of high powered incentives for providers. For a large class of incentive schemes, where the provider's compensation depends on the total number of successful projects, her announcement regarding the non-suitability of the transfer for certain types (low success probability for modern technology) is non-credible. Hence even though the relevant information is available, the agents do not benefit from it and we can obtain highly inefficient outcomes. Since the provider must incur some cost to acquire the relevant information before it can communicate, we have a *Catch-22* situation when this cost is non-verifiable and cannot be contracted. We need to have an incentive system to induce the provider to acquire information, but by the creation of this

[2] An example in agriculture can be found in the adoption of High Yielding Variety (HYV) seeds. While HYVs are certainly more productive, they are also more sensitive to know-how and resource base of the recipient farmers.

[3] Note that in any such modernization process it is not possible to rule out lower income *ex post.* But in the present context, for certain farmers or in certain cases, modern technology may fail to dominate current practice in an expected sense.

incentive we render the process of communication ineffective.

The situation is improved when we have motivated providers who would acquire and communicate this agent-relevant information.[4] These motivated providers are driven by the mission to help the disadvantaged (low-skilled in our context) and derive some private benefits from doing so. However, we also have non-motivated or typical providers who respond only to pecuniary incentives. The agents have no way of knowing whether they face a motivated or a typical provider. In the absence of any high-powered incentives, the presence of these typical providers does not affect communication between motivated providers and the agents, but with the introduction of incentives communication breaks down due to the presence of the typical providers. Hence, in the presence of incentives, even the motivated providers are of little help. However, the negative implications of incentivization can be avoided when the donor is able to use a richer set of incentive schemes. Using state-dependent contracts, the typical providers can be incentivized to acquire and communicate information truthfully.

Our paper is related to several strands in the literature and we draw on many of these sources. Earlier papers by Dur and Swank (2005), and Gerardi and Yariv (2008) have emphasized the interplay between the acquisition and transmission of information by interested experts. In the case of Dur and Swank (2005), unbiased experts exert maximum effort, in a moral hazard setting, to acquire information. Hence the principal is better off hiring an expert whose preference is less extreme than her own. Gerardi and Yariv (2008) also look at costly information gathering but in their solution the principal employs multiple experts with opposite preferences. We study an entirely different agency setting where the motivated provider (expert) is more likely to incur costly effort to acquire information. Second,

[4]See Besley and Ghatak (2005) on the significance of these motivated agents. Francois and Vlassopoulos (2008) offers an exhaustive survey on the nature of prosocial motivation and delivery of social services.

the presence of the typical provider alongside the motivated provider does not help the donor (principal) in addressing the problem of communication failure.

The role and significance of various types of motivations has received attention from several economists recently. Besley and Ghatak (2005) point out that it might be cheaper to address the moral hazard problem of inducing effort by careful matching of motivated agents rather than the use of high-powered incentives. In our case, reliance on motivated agents may be the only way of solving the problem of information acquisition and communication. While the claim that introduction of incentives can be counterproductive because of demanding informational requirement is not new, a more recent literature shows that even when incentives are appropriately designed, we cannot be certain of efficient outcomes. This can happen since extrinsic motivations lead to crowding out of intrinsic motivations.[5]

In several principal-agent experimental settings, it has been noted that stronger incentives and control induce weaker performance by the agent. Benabou and Tirole (2006) and Ellingsen and Johannesson (2008) show that when agents care for esteem, material incentives may undermine esteem incentives. In our case, stronger material incentives do not crowd out motivational incentives of these providers, but material incentives enable the non-motivated providers to add noise to the communication process.

Signalling plays a key methodological role in many of these models of motivations. Individuals have private information regarding own characteristics and they try to signal these through generosity, superior performances or esteem enhancing acts.[6] Our model also involves signalling

[5] See Andreoni (1990), Benabou and Tirole (2003, 2006), Sliwka (2007), Ellingsen and Johannesson (2008) among others.

[6] It is not the case that only agents engage in signalling. There are cases where the principal also signals (through its choice of control, trust, incentive provision) about the private information held by the principal. In Sliwka (2007), the principal chooses the level of control over the agents to signal about the average level of trustworthy agents in the population. In Ellingsen and Johannesson (2008), the principal signals its altruistic

by the provider (and not the agents) but it is costless. In that sense it is closer to the literature on strategic information transmission and cheap talk (Crawford and Sobel (1992), Farrell (1995), Krishna and Morgan (2001)). It is well known that divergence of interests between the sender (provider) and receiver (recipient) can lead to communication failure. Our paper uses this intuition in a simple setting but with the added features that the sender has to acquire information before communicating and that the nature of incentive schemes for the provider has the potential to affect the degree of divergence in interests.

Finally, we do not make any general claims about the usefulness or otherwise of incentive schemes. Ours is an extremely stylized model with two-sided asymmetric information, which we elaborate in the text.[7] However, the interplay of incentives and communication failure is the novel feature of our analysis. Our exercise is a first step in the direction that shows that the interaction between communication and incentives can be problematic.

Section 2 sets up the model and Section 3 has the results. The final section summarizes.

2 The Model

We consider a simple variant of the standard principal-agent framework where there is a *Donor* who provides a fixed amount of funds denoted by M to a *Provider,* who then disburses the funds to the *Recipients (* or *Agents).* The donor's role is limited to providing financing and setting up a compensation scheme for the provider. Most of the paper is about the

characteristics.

[7]In our model the provider does not know the skill level of the recipients but is aware of the success probability of each type of recipient. The recipients on the other hand know their types but do not know the success probability since they do not know the state of the world.

interaction between the provider and the agents.

Money from the donor is used to fund projects that are undertaken by the agents. Each project costs an amount T; hence a maximum of $\frac{M}{T}$ projects can be financed. Note that the funding need not only be in the form of cash transfers, it can also take the form of transfer of production technology. We discuss the details of this technology transfer, payoffs, and strategies of the provider and agents below.

2.1 Agents

We assume that there exist two types of agents - high skill (h) and low skill (l). The total population (of agents) is denoted by $N = N_h + N_l$ where N_h and N_l are the number of high-skilled and low-skilled agents respectively. We denote by λ the fraction of h-type agents in the population. Each agent can supply 1 unit of labor in an inelastic manner and is assumed to be risk neutral. In the absence of donor provided funds (which can be interpreted as the subsistence sector using traditional technology) output does not depend on skill type and is given by

$$X_i = \alpha \qquad i = h,l \tag{1}$$

where $\alpha > 0$.

The transfer T enables the agents to pursue a project with varying returns. For simplicity we consider only two outcomes: the project results in output $Y_i > 0$ when it is successful, and zero otherwise. The probability of success for the h-type is given by $p_h > 0$. For the low-skilled agents, on the other hand, the project success probability depends on one or more factors which are summarized by the state of nature θ. For simplicity, we consider two possible states $\theta \in \{G, B\}$ where G denotes the good state and B the bad state. The commonly held prior belief about the probability that $\theta = G$ is given by $\mu > 0$. The success probabilities of the l-type are given by p_{lG} and p_{lB} with $p_h > p_{lG} > p_{lB} > 0$.

Output in the successful state and expected outputs for both types are given below.

$$Y_i = \beta \quad i = h,l \tag{2}$$

$$E(Y_h) = p_h\beta \tag{3}$$

$$E(Y_l \mid \theta = G) = p_{lG}\beta \text{ and } E(Y_l \mid \theta = B) = p_{lB}\beta \tag{4}$$

Note that $\beta > \alpha$. We assume that

$$p_{lG}\beta > \alpha > p_{lB}\beta. \tag{A1}$$

Thus when $\theta = G$, both types are better off (in an expected sense) by undertaking the project but the h-type is more likely to succeed. However when $\theta = B$, the l-type is better off using traditional technology and not undertaking the project. To highlight the role of communication, we only consider the case where the prior μ is such that the low types will choose to undertake the project, i.e.,

$$\{\mu p_{lG} + (1-\mu)p_{lB}\}\beta > \alpha \tag{A2}$$

2.2 Provider

In our model the provider has two unique roles: (i) only she can distribute funds to the agents, while being unable to identify their skill types; (ii) only she can learn the true state θ by incurring costly effort e. We assume that[8]

[8] More specifically, the agents are able to observe whether the provider has undertaken the efforts to learn θ. The donor may not oberve e, additionally the donor might consider writing contracts (based on effort) to be prohibitively expensive, and/or even when they

$$\text{effort } e \text{ is observable but not contractible, with } e \in \{0, 1\}. \quad \text{(A3)}$$

We focus on a class of performance based schemes where monetary payments to the provider depend on the number of successful projects. Let the number successful projects be denoted by m, which is observable and verifiable. To begin with, we consider a typical risk neutral provider whose payoff is given by

$$U = Z(m) - d(e), Z^{/}(m) \geq 0,\ d(0) = 0 \text{ and } d(1) = E > 0, \quad \text{(A4)}$$

where $d(e)$ is the disutility of effort. This also includes fixed compensation scheme with $Z(m) = Z$. Later in Section 3.5 we consider more general compensation schemes where Z depends on other observable variables too. The provider's reservation utility is denoted by $\overline{U} \geq 0$. Clearly, the donor has to design a suitable incentive scheme for the provider so that the latter undertakes the desired effort to learn the realized θ.

2.3 Information and Time Line

We assume that the output parameters α, β, the success probabilities p_h, p_{lG} and p_{lB} and the compensation scheme chosen by the donor are commonly known. We assume that the agents (for whom this may be thought of as new technology) and the donor do not know the realization of θ. In the model the low-skilled agents know the success probabilities associated with the good and bad state, but do not know θ. The provider learns the true state through costly effort and can communicate this by sending a signal

can be written, contracts may not be enforceable.

$S \in \{G, B\}$ to the agents. The donor is neither able to observe nor verify this signal. We relax this assumption later, but it makes sense since the donor is normally far removed from the field. Finally, once all projects are undertaken and outcomes realized, the donor can verify m. The sequence of moves in this game is as follows.

1. Donor provides M to finance $(\frac{M}{T})$ projects and specifies the provider's compensation scheme $Z(m)$.

2. Provider chooses e,and if $e = 1$,makes announcement $S \in \{G, B\}$.[9]

3. Agents update their beliefs about θ and choose whether to apply (A) or not apply (NA) for the project.

4. Provider randomly selects a subset of all applicants (if the number of applicants exceeds the total number of possible projects) and transfers amount T to each of the selected agents. Let n be the total number projects funded. Then n_h and n_l denote the number of high skill and low skill agents selected to undertake the project respectively. Agents who are not selected produce using the traditional technology.

5. Outputs are realized and the donor learns the number of successful projects (m).

Our goal is to study the impact of various incentive schemes on the interaction between the provider and agent. Hence our equilibrium definition essentially captures the interaction in stages 2-3. An equilibrium is given by $\{e^*, S^*, a^*\}$ where e^* denotes the provider's choice of effort and S^* is her signal if $e^* = 1$. Agent i's choice is denoted by $a_i : \{G, B\} \longrightarrow \{A, NA\}, i = l, h$. Agents choose whether to apply or not apply based on their posterior belief $\sigma(S, \mu) : \{G, B\} \times [0, 1] \longrightarrow [0, 1]$. In the absence

[9] There is no announcement when $e = 0$. Hence the observability of effort decision is integral to our analysis.

of any communications, $e^* = 0$, agent's choice is determined by the prior belief μ. We now study the Perfect Bayesian Equilibria (PBE) of this game (stage 2-3) assuming $e^* = 1$. For a given equilibrium, the corresponding project allocations will be denoted by n_h^*, n_l^*.

3 Results and Analysis

We first illustrate the role of communication in our setup. Then we examine efficiency implications of incentive schemes for the providers and introduce the motivated provider. Initially we focus on a single class of incentive schemes where the provider's compensation depends on the total number of successful projects. Later in the section, we consider more general incentive schemes.

3.1 Communication

In order to demonstrate the importance of communication, we begin with the payoff matrix shown below. These payoffs are for illustration purposes only and are not derived from the payoff specifications discussed earlier. Hence we have suppressed the effort dimension here. The provider is designated as the row player and the low-skilled agent is the column player. The first element in each box refers to the provider's payoff and the second refers to the agent's payoff.[10] The provider makes the announcement S about θ and the agent chooses whether to apply (A) or not (NA) in the two different states. The payoffs capture the idea that the agent is better off choosing NA in the bad state, and prefers A in the good state. Moreover, in the bad state, the provider also prefers the agent to choose NA. Of

[10] The high-skilled agent is missing from the analysis because her choice is not affected by the provider's announcement.

course, in the good state the provider's preference over the agent's choice depends on the relationship between x and γ.

	A	NA
$\theta = G$	x, X	γ, 0
$\theta = B$	0, $-Y$	3, 0

Game 1

Suppose, $x \geqslant \gamma$, it is clear that communication is informative. It is easy to verify that we have a PBE where

$$\begin{aligned} & S^*(G) = G,\, S^*(B) = B, \\ & a^*(B) = NA,\, a^*(G) = A, \\ & \sigma(G, \mu) = 1,\, \sigma(B, \mu) = 0. \end{aligned} \tag{5}$$

It is of course true that we also have the uninformative 'babbling' equilibrium where $\sigma(S, \mu) = \mu$, $\forall S$. The agent learns nothing from the announcement by the provider and the provider's equilibrium announcement $S^*(G) = S^*(B)$. We do not go in to equilibrium selection issues here and assume that whenever the fully informative equilibrium exists, player will choose to play according it.

Next suppose that $x < \gamma$. In the good state $\theta = G$, the provider's payoff is higher whenever the (low-skilled) agent chooses NA. This makes the announcement of $S(B) = B$ non-credible because the agent realizes that the provider would like the agent to believe the state to be B even when $\theta = G$. Hence the equilibrium described in (5) cannot be sustained. In fact, the only PBE in this case is the uninformative babbling equilibrium where the agent chooses A irrespective of the announcement.

3.2 Efficiency

Suppose that for a given M, the donor is interested in maximizing total (expected) output V resulting from project allocations. This amounts to maximizing total success probabilities. Let $n_{i\theta}$ denote the number of projects allocated to type-i agent in state θ.[11] Hence the donor maximizes

$$V = [p_h n_h + \{\mu p_{lG} n_{lG} + (1-\mu) p_{lB} n_{lB}\}]\beta. \tag{6}$$

We consider two benchmark cases where the agents know the realization of the state θ. This implies that communication is irrelevant, we assume that the donor does not employ any provider in these two cases. First consider the case where, in addition to agents knowing θ, information about skill types are known by the donor (as well as the agents). Since the agents know θ, the outcome must satisfy the interim participation constraints, $E(Y_i \mid \theta) \geq X_i$. Given (A1), it is clear that V is maximized, **subject to the participation constraints**, by the following allocation.

$$\begin{aligned} n_h^* &= \frac{M}{T}, \quad \text{for } N_h \geq \frac{M}{T} \\ n_h^* &= N_h,\ n_{lG}^* = \frac{M}{T} - N_h, \text{ and } n_{lB}^* = 0, \text{ for } N_h < \frac{M}{T} \end{aligned} \tag{7}$$

Remark 1 *We refer to this as the first-best outcome. When $N_h \geq \frac{M}{T}$, only the high-skilled agents get the project in both states. In the complementary case, $N_h < \frac{M}{T}$, low-skilled agents are allocated the remaining projects in the good state but no projects in the bad state. The low-skilled agents who are refused these projects can always use the traditional technology to produce α. Hence this does not involve welfare loss for the low-skilled agents in the bad state.*

[11] When the allocation of a type is same in both states, we will drop the θ subscript for convenient reading.

This outcome is clearly interim efficient but *ex post* inefficiency cannot be ruled out because of the non-deterministic nature of the output. Moreover, interim efficiency requires that some amount of funds will remain unused when $\theta = B$, and $N_h < \frac{M}{T}$. For the remainder of the paper we will focus on the case when $N_h \geq \frac{M}{T}$ as this is sufficient to illustrate the trade-off between costly communication and incentives of the provider, when we depart from the benchmark case.

Next consider the case where agents know θ but the donor has no information about skill types. Hence projects are allocated randomly among the applicants. In the context of our simple example, we have a finite set of outcomes depending on how the different types apply in the two states. When the low-skilled cannot be prevented from applying, it is clear that expected output V is maximized when the low-skilled apply in the good state but not in the bad state. The maximizing allocation is given below,

$$n_{hG}^* = \lambda \frac{M}{T},\ n_{lG}^* = (1-\lambda)\frac{M}{T}, n_{hB}^* = \frac{M}{T}, n_{lB}^* = 0 \tag{8}$$

Remark 2 *We refer to it as the second-best outcome. This outcome is also interim efficient. There are several other interim efficient allocations with $n_{l\theta} > 0$, satisfying $E(Y_i \mid \theta) \geq X_i$, but this allocation yields the highest expected output in this class.*

Finally, we could also consider a third case where the agents are uninformed but the provider has information regarding the skill types. But with $N_h \geq \frac{M}{T}$, this case is equivalent to the first-best outcome.

3.3 Incentives and Communication Failure

We now return to our model setting where the donor is uninformed about θ as well as skill types. The question we want to answer is whether the donor can achieve the efficient outcomes described in (7) and (8) by hiring a provider and providing suitable incentives.

Given that $N_h \geq \frac{M}{T}$, the first-best outcome can only be achieved by preventing the l-types from applying in the bad as well the good state, and this is impossible to achieve. Recall that in the absence of any communication about the realized state, assumption (A2) implies that both types will apply to undertake the project. For the low-skilled agents to revise their prior belief we need (i) the provider to engage in costly effort and acquire information about the realized θ, and (ii) credibly communicate this information. There is a basic tension between these two. Since effort is not contractible, the provider can only be incentivized by making their compensation depend on the outcomes. Since the compensation scheme is assumed to be common knowledge, the communication game between the provider and l-type agents will have a payoff matrix that is similar to the one specified in Game 1 with $x < \gamma$. We know that the only equilibrium in this case is the uninformative babbling equilibrium.[12] Hence the benefits of communication are non-existent and the provider is better off not acquiring any information. Thus for communication to be effective we need $Z'(m) = 0$, but for the provider to acquire information we need $Z'(m) > 0$. Clearly it is not possible to have both simultaneously, rendering high-powered incentives completely ineffective. We summarize this in our first proposition.

Proposition 1 *Suppose (A1)-(A4) hold. Let $N_h \geq \frac{M}{T}$. For any compensation scheme $Z(m)$, both types apply in all states and $n_h^* < \frac{M}{T}$, $n_{l\theta}^* > 0$, for $\theta = G, B$.*

It is clear that neither of the efficient outcomes can be achieved. It is

[12] In a related context, Macchiavello (2008) studies the role of public sector wage premium in screening and ensuring worker honesty. His focus is on the impact of such incentive schemes on corruption, while we examine their impact on credible communication.

easy to verify that in this case $n^*_{h\theta} = \lambda\frac{M}{T}$, $n^*_{l\theta} = (1-\lambda)\frac{M}{T}, \theta = G, B$. The total expected output V will be given by

$$V = \left[p_h\lambda\frac{M}{T} + \{\mu p_{lG}\frac{M}{T} + (1-\mu)p_{lB}\frac{M}{T}\}\{1-\lambda\}\right]\beta. \quad (9)$$

Our objective has been to highlight the possible tension between incentives and coomunication. It is clear that the donor's strategy set has been severely restricted and we can relax this. It is possible to consider direct revelation mechanisms where donor makes transfers based on the signal, or non-monotonic contracts where success over a certain limit is penalised or finally state-dependent contracts where compensation depends on not just success but also the state. Alternatively, we can leave the donor unchanged (which is closer to our examples of aid provision or microfinance) but consider the possibility that providers are mission oriented to varying degrees (see Besley and Ghatak (2005)) and care about things other than monetary compensation. We turn to these in the next section.

3.4 Motivated Providers

We suppose that the motivated providers derive additional *private benefits* which are Rawlsian in nature: they seek to maximize the expected benefit to the most disadvantaged group − the low-skilled agents. Hence a motivated provider's utility depends on these private benefits, compensation from the donor and possible disutility of effort. The population of providers consists of both the typical providers (denoted by τ) and motivated providers (denoted by ρ). We assume that the fraction of motivated providers is δ.[13] Recall that the typical providers simply maximize $Z - d(e)$,

[13] This fraction of motivated providers might depend on the nature of incentive schemes due to self selection, but we do not address this issue. See Delfgaauw and Dur (2007) for an analysis of incentive wages and workers' self selection in firms.

which we relabel as U^{τ}.

We now turn to the utility of the motivated providers. In state $\theta = G$, the (marginal) expected benefit to the l-type from the new technology will be $(p_{lG}\beta - \alpha) > 0$ and the provider's private benefit is maximized when n_l is maximized. On the other hand, in state $\theta = B$ the (marginal) expected benefit of the new technology to the low-skilled type will be $(p_{lB}\beta - \alpha) < 0$ and the provider's private benefit is maximized when n_l is minimized. Thus the motivated provider's private benefits are state dependent. We can rewrite the motivated provider's payoff as

$$U^{\rho} = Z - d(e) + I(\theta)n_l k - J(\theta)n_l k', \;\; k', k > 0 \tag{10}$$

where $I(\theta) = 1$ when $\theta = G$, and zero otherwise. Similarly, $J(\theta) = 1$ when $\theta = B$ and zero otherwise. The constants k, k' reflect the weights placed by the provider on agent's benefit in different states.

From the above payoff function it also follows that, in the absence of any incentives, for $\theta = G$ the motivated provider prefers the l-types to undertake the project. This implies that the motivated provider would like to screen out the l-types in the bad state since they are better off using traditional technology. An example of such motivated providers would be loan officers working for a MFI who would not advance loans to someone that is most likely to be severely indebted; not because the MFI's repayment rates are going to be adversely affected, but because the client is strictly worse off.

3.4.1 Intrinsic Motivations Only

Suppose there are no extrinsic incentives for the providers, i.e. Z is fixed and not performance based. Then the motivated provider will choose $e = 1$ and communicate the realized state to the agents. The typical provider chooses $e = 0$ and does not observe the realized state as effort is costly.

We show that there is an equilibrium where the motivated provider truthfully conveys information regarding the state and the l-types do not apply in the bad state. Note that given the objective function of the motivated provider, the communication game resembles Game 1 with $x \geq \gamma$. This means the provider would like the l-types to apply in the good state but not in the bad state, making their announcement credible. Consequently, the low skilled agent chooses its strategy as follows: $a(G) = A$, and $a(B) = NA$. It is easy to verify that the typical provider does not have any incentive to deviate and acquire information to take advantage of the credibility of communication. Since compensation Z does not depend on the outcome, doing so would simply lead a reduction in equilibrium payoff by $d(1) = E$. So in this setting, with probability δ we get the outcome where only the high types apply in the bad state and with probability $(1-\delta)$, we get the inefficient outcome where all types apply in both states. Equilibrium strategies are given by

$$
\begin{aligned}
e^*_\rho &= 1,\ S^*_\rho(G) = G,\ S^*_\rho(B) = B, \\
a^*_h &= A;\ a^*_l(G) = A \text{ and } a^*_l(B) = NA. \\
e^*_\tau &= 0,\ \ a^*_h = a^*_l = A
\end{aligned}
\tag{11}
$$

The corresponding allocation is given by

$$
\begin{aligned}
n^*_{hG} &= \lambda\frac{M}{T},\quad n^*_{lG} = (1-\lambda)\frac{M}{T}, \\
n^*_{hB} &= \delta\frac{M}{T} + (1-\delta)\lambda\frac{M}{T},\quad n^*_{lB} = (1-\delta)(1-\lambda)\frac{M}{T}.
\end{aligned}
\tag{12}
$$

When $\delta = 1$, this reduces to the second-best outcome (8) and expected output is given by

$$V = \left[\mu\{p_h\lambda\frac{M}{T} + p_{lG}(1-\lambda)\frac{M}{T}\} + (1-\mu)p_h\frac{M}{T}\right]\beta. \qquad (13)$$

It can be seen that expected output in (13) is higher than the expected output under typical providers with incentives (9). Even when $\delta < 1$, the above allocation with motivated providers and fixed compensation dominates the previous allocation listed in proposition 1. However, the first-best can never be achieved with the motivated providers, because the motivated providers would always prefer the low skilled agents in the good state.

We summarize this in the following proposition.

Proposition 2 *Let $N_h > \frac{M}{T}$. (a) When all providers are motivated, $\delta = 1$, the second-best outcome shown in (8) can be achieved. (b) When some providers are motivated, $\delta > 0$, the donor achieves higher expected output compared to the case with only typical providers.*

3.4.2 Intrinsic Motivations and Incentives

In the previous analysis, the presence of typical providers has no effect on the credible communication between the motivated providers and the agents. But this is not necessarily true when the provider is incentivized with $Z'(m) > 0$. For the motivated provider this does not change any of the equilibrium strategies for sufficiently large values of k and k'. Consider the equilibrium strategies given in (11) and the corresponding outcome. The motivated provider's effort choice is still given by $e_\rho = 1$. It is clear that they will choose to communicate truthfully in the bad state. But will they choose $S = G$ when the realized state is G? There may exist situations depending on the proportion of high-skilled agents (λ), where $Z(m)$ can be lower according to the equilibrium strategy in (11). However it is easy to show that there exists $k \geq k_\lambda$ such that the motivated provider will not deviate to $S = B$, where k_λ is given by the solution to the following[14]

$$Z(p_h \frac{M}{T}) = Z\left(p_h \lambda \frac{M}{T} + p_{lG}(1-\lambda)\frac{M}{T}\right) + (1-\lambda)\frac{M}{T}k_\lambda. \tag{14}$$

But the incentive scheme has a significant impact on the typical provider's strategies. Given the strategies of the motivated provider and the agents, the typical provider will benefit from deviating to $e_\tau = 1$ and $s(G) = B$ if the following is satisfied,

$$Z(p_h \frac{M}{T}) - E \geq \mu Z\left(p_h \lambda \frac{M}{T} + p_{lG}(1-\lambda)\frac{M}{T}\right) + (1-\mu)Z\left(p_h \frac{M}{T}\right). \tag{15}$$

The right hand side expression in (15) is the payoff to the typical provider in such an equilibrium, but with $Z'(m) > 0$. For given effort level and λ, this condition depends on the slope of the compensation function Z. The slope can be interpreted as the *power of the incentive scheme*, with a higher value of the slope implying high-powered incentives. If compensation is highly responsive to the outcome (in this case m) then the typical provider will deviate. Suppose, $Z(m) = z.m$. Then the equilibrium outcome given by (15) cannot be sustained if $z > z^0$, where z^0 is given by

$$z^0(p_h - p_{lG})\mu(1-\lambda)\frac{M}{T} = E. \tag{16}$$

Once the typical provider also makes announcements, the agents have no way of separating the typical provider's announcement from that of the motivated provider. The signal B could come from a typical provider in state G, or it could come from both types of providers in state B. It can be checked that the posterior belief that the state is good, when $e_\tau = e_\rho = 1$ and the signal is B, is $\sigma(G \mid B) = \frac{(\mu - \delta\mu)}{1-\delta\mu} \equiv \sigma_\delta$. Note that for a given prior

[14] In the context of crowding out, as discussed earlier, this can be interpreted as intrinsic motivation being sufficiently strong.

μ, the agent's posterior belief σ is determined by the fraction of motivated providers δ. A high value of σ induces the l-type agents to apply. Hence, when there are large number of typical providers and agents' belief about the underlying state being good is high, all agents will apply even when the state is bad. Since, according to assumption (A2), $\mu p_{lG} + (1-\mu)p_{lB} > \frac{\alpha}{\beta}$ and $\sigma_\delta \longrightarrow \mu$ as $\delta \longrightarrow 0$, there exists δ^0 such that

$$\sigma_\delta p_{lG} + (1-\sigma_\delta)p_{lB} \geq \frac{\alpha}{\beta} \text{ for all } \delta \leq \delta^0. \tag{17}$$

Hence the introduction of high-powered schemes leads to a communication failure even in the presence of motivated providers if these incentives are powerful enough to induce costly information gathering by the typical providers. This is summarized below.

Proposition 3 *Consider linear compensation schemes $Z(m) = z.m$ with high-powered incentives $z > z^0$ (ref 16). When the fraction of motivated providers is small, $\delta < \delta^0$ (ref 17), in any equilibrium both types of agents apply in all the states.*

This suggests that when faced with a mixed population of motivated and typical providers, the donor is better off not using any incentive schemes. Information acquisition by the typical providers adds noise to the communication by the motivated providers and it leads to lower expected output.

3.5 State-Dependent Contracts: An Illustration

The previous analysis shows how intrinsic motivations could be effective where extrinsic motivations through incentives failed to do so. However, in our previous example, the donor was restricted to a small class of contracts based on total number of successes or failures. Suppose the donor can observe and verify the state *ex post* and condition compensation contracts on the realization of θ. Using this expanded set of feasible contracts we can show that extrinsic motivations can be made to work. However, it may be hard to verify θ in many situations and motivated providers remain the best answer in such scenarios.

Since motivated providers do not need any incentivization and our result concerning ineffectiveness of incentivization (Proposition 1) had only typical providers, here also we confine attention to a world with typical providers only and drop the subscript τ. As is obvious from Proposition 1 and analysis in Section 3.3, high-powered incentives lead to communication failure because in state $\theta = G$, the provider has an incentive to dissuade the l-types from applying by announcing B. Hence the provider's preference over types in the good state is responsible for undermining credibility. We can design an incentive scheme where the provider has an incentive to acquire information but at the same time, it is not affected by which types apply in the good state. Since states are *ex post* verifiable and hence contractible we can consider the following contract:

$$Z = \overline{Z} \text{ if } \theta = G, \; Z = \overline{Z} - (n_l + n_h - m)f \quad \text{if } \theta = B, \tag{18}$$

where $\overline{Z}$ is some fixed payment and f is the penalty for each unsuccessful project. We can find suitable $\overline{Z}$ and f such that the following participation and incentive constraints are satisfied.

$$\overline{Z} - (1-\mu)(1-p_h)\frac{M}{T}f - E \;\geq\; \overline{U}, \tag{19}$$

$$(1-\mu)\frac{M}{T}f(1-\lambda)(p_h - p_l) - E \;\geq\; 0. \tag{20}$$

It is easy to verify that such a compensation scheme is feasible and the provider will choose $e = 1$. Moreover, in state $\theta = G$, the provider has no incentive to lie and choose $S = B$. Likewise, in state $\theta = B$, an announcement of $S = G$ will lead to a lower payoff for the provider. Hence, we have an equilibrium where

$$\begin{aligned} e^* &= 1,\ S^*(\theta) = \theta,\ \text{for } \theta = G, B, \\ a_h^* &= A,\ a_l^*(G) = A,\ a_l^*(B) = NA. \end{aligned} \tag{21}$$

Clearly, this will lead to an allocation given by $n_{hG}^* = \lambda \frac{M}{T}$, $n_{lG}^* = (1 - \lambda)\frac{M}{T}, n_{hB}^* = \frac{M}{T}, n_{lB}^* = 0$. Hence the second-best outcome can be achieved by this contract. Note that this is the same outcome which can be achieved with motivated providers. Expected output from donor's perspective will be

$$V = \left[\mu p_h \lambda \frac{M}{T} + \mu p_{lG}(1-\lambda)\frac{M}{T} + (1-\mu)p_h \frac{M}{T}\right]\beta. \tag{22}$$

In our simple example, the provider can use other contracts too.[15] Since we have two states and two types, the number of successful projects can be ordered according to states. Let m_1 be the number of successes when only high-skilled types undertake projects, and the number of successful projects with both types applying in good and bad states will be given by m_2 and m_3 respectively. Clearly, $m_1 > m_2 > m_3$. Consider the following contract:

$$Z = \overline{Z},\ \text{if}\ \ m \geq m_3 - \epsilon, \text{and} \tag{23}$$

$$Z = 0, \text{otherwise, for } 0 < \epsilon < m_3 - m_2. \tag{24}$$

This is identical to the state-dependent contract discussed earlier. Observe that the provider is not affected by the presence of low-skilled agents in the

[15] These need not be state dependent but serve the same purpose as the state dependent contract.

good state and hence communication is credible.

3.6 Donor's Objectives

The above discussion has brought out the donor's objective into the picture. Throughout we have assumed that the donor is interested in maximizing total expected output. However, it is not the case that donors have to be interested in maximizing returns on every dollar spent. Suppose the donor is interested in only avoiding the worst case, i.e. preventing low-skilled agents from undertaking the project in the bad state but has no preference over types in the good state.[16] Hence the donor does not care about n_{lG} or n_h. Such a donor can use a contract similar to (18) where failed projects in state B are penalized. If the donor can identify the different failed types then we could even target only failures by l-types in the bad state. With such a contract the interests of the providers, both motivated as well as typical, are aligned with the interests of the agents. Hence the donor can achieve an allocation with $n_{lB} = 0$.

When the donor cares only about successful projects the total number of success is bounded above by what is implied by the second-best outcome. The best an output maximizing donor can do is identical to what a donor, who is interested in avoiding the worst case scenario, would do to prevent low-skilled agents from undertaking the project in the bad state. Thus the output maximizing donor is observationally equivalent to the one who wants to avoid the worst case outcome.

[16] This would of course include the case where the donor would like the low-skilled agents to get the project in the good state. If wealth and skill level are positively correlated, one can justify such objectives.

4 Conclusion

Effective delivery is a critical component of development efforts. Using a simple and stylized setting, we have shown that introduction of high-powered incentives can lead to communication failure and undermine the very reasons for the introduction of incentives. Despite the context-specific nature of our example, our analysis is relevant to the general case of provisioning of goods and services identified by two distinctive features: *non-commercial intent* and reliance on *non-price allocation mechanisms*. Examples of these are transfer of modern technology, technological know-how, loans and grants as well as aid to the poor. This framework can also be used to study programs like the provisioning of health services, education and many other public goods. Whenever agents' relevant characteristics are not commonly observed, communication is important and informational problems arise in the absence of effective communication. The severity of the problem can be gauged by the fact that in these situations, even though some types of agents are likely to be worse off than their current status, they end up receiving the transfers.

An instance of such communication failure and inefficient uptake can be found in the recent micro-lending programs of several microfinance institutions. A major crisis broke out in March 2006 when around 50 MFI branches in Andhra Pradesh (a state in India) were closed by the government because of complaints against practices of these organizations. Some authors, while analyzing this incident, commented on how indiscriminate lending was 'making a debt trap' for the poor.[17] It is argued that several individuals who (*ex ante*) had a very small chance of repaying the loans also entered into debt contracts. This was possible because of a breakdown in credible communication between the loan officers and the individuals.

[17] See Shylendra (2006) and Kumar (2006) for detailed accounts and analysis of this incident.

Excessive incentivization of the loan officers to maximize the number of clients can be listed as a major cause of this counter-productive outcome.[18]

While our result is related to the recent literature on intrinsic and extrinsic motivation, the emphasis on information flows and communication is a novel feature. We show that while the introduction of extrinsic motivations or incentives does not destroy the intrinsic motivations of the motivated providers, it makes the typical provider act in such a manner that communication between the motivated providers and agents breaks down.

Based on our stylized model, we believe that there are two issues which need to be noted. First, we have assumed (in most of the paper) that the number of high skilled agents exceeds the number of projects that can be financed. If this is not true then in some states the entire amount of funds supplied by the donor will not be spent. Donors who prefer full utilization (or disbursement) of funds will consider this outcome inefficient. But on the other hand, in the bad state where the low-skilled agents are better off not undertaking the project, it is better to have undisbursed funds. We only make a partial reference to this issue since it is not the main focus of our paper and does not generate additional insights. Second, the provider relies on a random allocation when the number of applications exceeds the number of projects to be financed. Since our focus was on communication, in our model the provider can affect the final allocation only by communicating the state-related information to influence the agents' decision to apply for projects. In practice however, the provider might undertake costly screening of the applications, an issue that has been left for future research.

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[18] In more general contexts, the recent literature on participatory development can also be viewed as attempts to adopt development practices where there is better information flow (about local preferences). See for instance Platteau (2009).

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