SUPERVISION AND PROJECT PERFORMANCE: A PRINCIPAL-AGENT APPROACH

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This paper applies and extends principal-agent theory to analyze the performance of donor projects. As in many situations, there is variation in the degree of divergence between the interests of the donor (the principal) and the recipient government (the agent). Further, the effort expended on supervision of the agent is a control variable. We first present a principal-agent model that shows that conditional on optimal contracting, the marginal effect of more precise supervision on the likelihood of project success is higher the wider the divergence of interests. We then test this prediction using data on project performance. We are able to measure the degree of divergence between donor and recipient interests, as perceived by the donor, through a donor classification system of recipient governments. Consistent with the theory, we find that donor supervision of projects is significantly more effective in improving project performance where interests are widely divergent.

I. INTRODUCTION

In many situations a principal must contract business with a range of agents whose interests are known to diverge to varying degrees from those of the principal. We analyze whether the principal should set her level of effort expended on supervision of the agent purposively so as to compensate for such differences in intrinsic motivation. We consider one particularly clear such situation, namely that in which a donor agency is required to finance development projects globally which are then implemented by recipient governments. The degree to which the interests of donor agencies and recipient governments are congruent varies radically between countries. The ideal situation is recognized to be one in which interests are coincident: the official language now used by donors to describe this is 'partnership'. While coincidence of interests is probably rare, in some situations it is manifestly unrealistic. Donor agencies, working together in the Development Assistance Committee of the OECD, have classified their dealings with a group of recipient governments as 'Difficult Partnerships'. These are, by definition, situations in which the donor (the principal) perceives an unusually wide divergence of interests between itself and the recipient government (the agent).

The principal-agent problem arises from the conjunction of non-congruent interests with the limited observability of agent effort. However, in most situations the degree of observability is not a given but is to an extent under the control of the principal. Since enhanced observation is costly, the principal must decide how much to spend on it for each agent. This is indeed the case in the context of a donor-financed project implemented by a recipient government. Donors supervise projects during implementation, and the degree of effort put into supervision is an important allocative decision for the managers of donor agencies.

This paper investigates whether expenditure on supervision should be related to prior information about the degree of divergence between the interests of the principal and the agent. That is, can more precise observation of agent effort offset divergent interests? In Section 2 we develop the theory, based on a simple principal-agent model. We introduce a measure for the degree of divergence between the interests of the principal and the agent, and a control variable through which the principal can, at a cost, increase the precision of her observation of the agent's effort. We show that under reasonable assumptions precise supervision is indeed a substitute for congruence of interests as long as the principal chooses optimally among the set of admissible contracts. With optimal choice of contract incentives are higher-powered the better the precision of supervision and lower-powered the more congruent the interests of the two parties.

In Section 3 we test the model empirically using data on donor projects. The data cover all World Bank projects evaluated by its Independent Evaluation Group (IEG). IEG rates completed projects by their degree of success. Previous analysis of these data has established that the ratings have informational content. Isham and Kaufmann (1999) show that policy differences within recipient countries systematically affect the probability of project success. IEG also measures and evaluates the degree of supervision provided during the course of project implementation. The supervision effort has been shown to be effective in raising the rate of success of World Bank projects (Kilby, 2000). Our question is whether this favorable effect of supervision is related to the degree of divergence of interests. The supervision effort put into a project is at the discretion of World Bank Country Directors who control operational budgets: in practice, the vagaries of budgeting and management produce wide variations in supervision effort. Corresponding to the OECD concept of ‘Difficult Partnerships’, the World Bank has its own classification of those recipient governments with which interests are likely to be most divergent, termed ‘Low-Income Countries Under Stress’, or ‘LICUS’ (World Bank, 2002). We thus have information on the performance of projects, the supervision effort put into each project, and the degree of divergence between the interests of the donor and the recipient government as perceived by the donor. This enables us to test both whether supervision is an effective substitute for congruence of interests, and whether allocative decisions on supervision effort are set consequentially. We find that while projects are considerably more likely to fail in countries where the government has widely divergent interests, supervision is differentially effective in increasing the probability of success. This is the case whether or not supervision is instrumented for in our econometric estimation. Hence, consistent with the theory, supervision is an effective substitute for congruent interests. However, while it might be expected that managers would allocate more supervision effort into those countries where interests are least congruent, in fact they do the opposite. We consider why the incentive environment facing managers might generate this apparently perverse outcome.

II. A MODEL OF DIVERGENT INTERESTS AND SUPERVISION

II.A. The Set-Up

This section presents a stylized model whose goal it is to provide a theoretical foundation for the empirical investigation in the remainder of the paper. The model is adapted from Baker, Gibbons and Murphy (1994)[1], which is in turn based on Baker (1992). It analyses the optimal contract between a risk-neutral principal (the donor, *D*; "she") and a risk-neutral agent (the recipient, *R*; "he"). The donor wants to implement a project in the recipient country. The outcome y of this project can be either 0 (failure) or 1 (success). The probability that it is a success is determined by the recipient's effort a: $\Pr(y = 1|a) = a$. One of the basic assumptions of the model is that, due to its complexity, y is not objectively measurable and therefore not contractible. It is also impossible to write contracts based on a. There does, however, exist a verifiable performance measure p (for instance based on a report by a project supervisor appointed by *D*) on which contracts can be based; this performance measure takes the values 0 or 1, and $\Pr(p = 1|a) = \mu a$. μ is a random variable which is only observed by the recipient (before he chooses his effort level); its expected value equals 1 and its variance ε^{-1} ($\varepsilon = \frac{1}{\mathrm{var}(\mu)}$ is the precision of the performance measure; it can be seen as measuring the quality of supervision). Thus, the performance measure is on average unbiased, but it is nevertheless distortive because it varies, and so does the recipient's effort as a consequence, despite the fact that the link between effort and contribution to project outcome is always the same. The fact that μ varies around 1 can be interpreted in this context as saying that there are projects where high effort increases both y and p (μ around one), projects where high effort increases y but not p (μ small), and projects where high effort increases p but not y (μ large). The fact that the recipient observes μ before choosing an effort level reflects the assumption that he observes the way in which supervision of the project will take place and therefore knows whether or not a high effort will be necessary to 'please' the supervisor (i.e. obtain p= 1).

[1] Unlike them, we only consider a one-shot setting; thus, reputational contracts (which are the focus of their paper) are ruled out.

We now assume that every project has a fixed overall cost of $c<1$, and that it is financed by the donor in two tranches, of sizes $(1-b)c$ and bc, respectively (where b is between 0 and 1). The payment of the second and final tranche of money, bc, can be made conditional on $p=1$. An implication is that p is the result of some interim evaluation, before the end of the project. As the model assumes that p and y are determined simultaneously, this means that when the evaluation takes place, it is already determined whether the project is a success or not, even though perhaps it cannot yet be observed by D.

The donor can choose b, the proportion of the money that she wants to be conditional on a positive evaluation, and ε, the precision of supervision (which comes at a cost).[2] The timing of the game is as follows:

1. D proposes a project contract $(b; \varepsilon)$;
2. R accepts or rejects; if he accepts, he receives the first tranche of $(1-b)c$ from D; if he rejects, receives his reservation payoff of 0;
3. If he accepts the contract, R observes μ and chooses a at personal cost $c(a)$ (both μ and a are unobservable to the donor);
4. y and p are realized; if $p=1$, D pays R the second tranche, bc.

Concerning the components of the recipient's utility function, we assume that his cost of effort is $c(a) = \gamma a^2$. Furthermore, we assume that he receives non-monetary utility of θy, with $\theta \in [0,1]$. This reflects the utility he derives from a successful outcome of the project, where θ measures the degree to which the interests of D and R are divergent or congruent.[3] If $\theta=0$, the recipient does not care at all about the outcome of the project; he only cares about the money he receives (and the effort he needs to exert to obtain it).[4] If $\theta=1$, he cares about the outcome to the same degree as the donor. It is assumed that θ is common knowledge and exogenously given.

The cost of precision to the donor is denoted by $C(\varepsilon,\theta)$, with $C_\varepsilon > 0$, $C_{\varepsilon\varepsilon} > 0$ and $C_{\varepsilon\theta} \leq 0$. Thus, the marginal cost of precision is (at least weakly) higher in an environment with divergent interests.

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[2] It may be natural to wonder how much the results in this section depend on the apparently artificial restriction to a one-dimensional space of contracts. This question is addressed in Appendix 1b).

[3] This is related to Besley and Ghatak (2005), where θ measures the extent to which a worker identifies with the mission of the organization he works for. Also see Fuster (2006).

[4] This is the assumption usually made in ‚traditional' principal-agent theory.

II.B. Results

D's objective function is given by:

$$\pi(b,\varepsilon;\theta)=E_{\mu}\left[a\cdot 1-(1-b)c-\mu a\cdot bc\right]-C(\varepsilon;\theta)\equiv V(b,\varepsilon;\theta)-C(\varepsilon;\theta),$$

where the last part within the square brackets reflects the idea that the second tranche (of size bc) is only paid if p=1, which happens with probability μa. $\pi(b,\varepsilon;\theta)$ is what the donor maximizes with respect to b and ε, taking into account R's expected reaction to the contract.

The recipient's utility function (once he has observed μ)[5] is given by:

$$U=a\cdot\theta+(1-b)c+\mu a\cdot bc-\gamma a^{2}.$$

All of the following propositions obtained from solving the model are proved in Appendix 1a). Starred letters denote optimal values.

PROPOSITION 1. The optimal size of the second tranche, $b^{*}c$, decreases in θ and increases in ε (we consider ε as given for the moment). ($b^{*}c$ increases in γ.)

The trade-off is evident: a higher b provides incentives for R to exert effort (which is good for D), but it also has a cost, as the available performance measure is distortive. This cost is however lower the higher is precision ε, such that a higher b is optimal. Furthermore, when interests are more congruent (θ high), there is less need for monetary incentives, as θ and b both lead to higher (expected) effort of R.

For what follows, we denote by $V^{*}(\varepsilon;\theta)\equiv V(b^{*},\varepsilon;\theta)$ the value of the contract to D for a given level of precision ε (exclusive of the cost of precision, $C(\varepsilon,\theta)$), and by $\pi(\varepsilon;\theta)=V^{*}(\varepsilon;\theta)-C(\varepsilon;\theta)$ the overall objective of the donor.

[5] His ex-ante utility (before he has observed μ), relevant for the participation decision, is $E_{\mu}(a^{*}\theta+(1-b)c+\mu a^{*}bc-\gamma a^{*2})$. As it is assumed that his outside option (what he gets if he rejects the project proposal) is 0, it is however easy to show that his participation constraint is always satisfied, such that his ex-ante utility plays no role.

PROPOSITION 2. $V^*(\varepsilon;\theta)$ as well as the expected probability of project success increase in ε and θ. The second cross-partial derivatives $\frac{\partial^2 V^*}{\partial\varepsilon\partial\theta}$ and $\frac{\partial^2 \Pr(success)}{\partial\varepsilon\partial\theta}$ are negative.

The first part of the proposition is unsurprising: both precision of supervision and congruence of interests have a positive impact on the probability of project success and on the value of the project to the principal if the optimal b is chosen.

The second part of the proposition displays the central result of this section. The negative cross-partials signify that the (marginal) positive effect of increased precision is stronger the more divergent the interests of *D* and *R;* ε and θ are substitutes. Hence, we expect that increased precision has a stronger impact on the likelihood of project success in 'difficult partnerships'.

This does not necessarily imply that the donor should choose higher precision in such circumstances. As the next proposition shows, whether this is the case depends on the shape of the cost-of-precision function:

PROPOSITION 3. The optimal choice of precision, $\arg\max_{\varepsilon} \pi(\varepsilon;\theta)$, is (weakly) decreasing in θ as long as $\frac{\partial^2 C}{\partial\varepsilon\partial\theta} \geq \frac{\partial^2 V^*}{\partial\varepsilon\partial\theta}$, and increasing in θ otherwise.

Thus, as long as the cross-partial of the cost-of-precision function is not 'too negative' (a negative cross-partial means that a marginal increase in precision is more expensive the wider the divergence of interests), we would expect that the donor chooses a higher precision level in circumstances where interests are divergent than in circumstances where they are congruent. Only if precision were much more costly in 'difficult partnerships' might it be optimal for *D* to choose a lower ε despite its differential effectiveness.

III. AN APPLICATION TO THE PERFORMANCE OF DONOR PROJECTS

III.A. Context and Data

The World Bank is required by its mandate to undertake development projects in a large majority of the world's low-income countries. Only in the most extreme environments such as Somalia does it actually suspend its project operations. The World Bank does not itself implement projects. Its normal mode of operation can be decomposed into a series of discrete phases. In the first phase, *preparation*, agreement is reached with a recipient government on the content and design of the project. Once approved by the Bank's Board, the project then enters the *implementation* phase. During implementation, which is undertaken by the government, the project is financed in tranches released by the World Bank. Each tranche requires the authorization of World Bank management and so provides a review point. To inform the management review the World Bank undertakes supervision, a report being prepared ahead of each tranche release. If the project is judged to be seriously off-track it can be aborted or scaled down on the decision of World Bank management. The frequency and scale of the tranches is determined during the preparation phase, but since the finance is heavily consessional the Bank has effective power of decision. The wider is the perceived divergence of interests with the recipient government the more is the project liable to be 'back-loaded', with less money released in the first unconditional tranche. This accords both with the theory of Section 2, in which b is varied according to θ, and also with the natural risk aversion common to public bureaucracies. The extent of effort put into supervision at each stage is a choice of World Bank management: Country Directors are assigned overall administrative budgets and can choose how to allocate this across a wide range of functions. Once completed or aborted, the project is evaluated. The evaluation is completely independent of the department which is responsible for the project. The IEG reports directly to the Board of the World Bank and its staff are not permitted to move to positions in other parts of the Bank. IEG evaluates the performance of the project in discrete categories: highly successful, successful, partially successful, failure. In practice, the key distinction is between the two former categories and the two latter (data and variables are presented in Appendix 2). IEG also separately evaluates the supervision effort by the World Bank and the preparation effort by the recipient government (highly satisfactory, satisfactory, unsatisfactory, highly unsatisfactory).

Our data from IEG covers more than 2,000 projects in 102 countries and is comprehensive. Of these, around 400 projects were in 'LICUS' countries, that is in countries which the Bank itself regarded as having governments whose interests were particularly divergent from those of the World Bank.

III.B. Results

In Table 1 we report a series of probit regressions in which the dependent variable is the probability of project success. First we introduce a range of control variables. As found previously by Isham and Kaufmann (1999), the better is policy the higher is the probability that the project will be a success. We measure policy here by the Country Policy and Institutional Assessment (CPIA), which is an internal rating of twenty different aspects of policy by the World Bank. The level of income also affects the probability of success: projects work better in higher income countries. Both preparation and supervision as assessed by IEG also significantly improve the probability of success, the latter being consistent with the results of Kilby (2000).

Our interest is in the interaction of a dummy variable for countries regarded as having particularly divergent interests and supervision. The 'LICUS' classification used by the World Bank only classifies countries since 2002. However, that classification is based on a combination of income and CPIA data and so it is possible to generate an imputed classification of LICUS-type status for all previous years. We use these criteria to generate a project-specific dummy variable which reflects whether, at the time during which the project was in its implementation phase, the country met the criteria for being a LICUS. Since the actual implementation phase is potentially endogenous to performance, we use the closing date for the project that was anticipated at the time of the presentation of the project for approval by the Board of the World Bank. As such the dummy variable is likely to be a close approximation to the concept of 'Difficult Partnership' and hence to the set of countries whose governments at the time of the project were known to have interests that were particularly divergent from those of the World Bank.

We introduce this dummy variable for divergent interests directly into the probit and also interact it with both preparation and with supervision. The direct effect is insignificant. This does not imply that divergent interests do not affect performance. Since both the level of income and the CPIA score are included in the regression, the dummy variable which is derived from them adds no information.[6] We now consider the interaction between divergent interests and donor choices. First, we consider the interaction between divergent interests and project preparation. The direct effect of project preparation is significant and positive: a better prepared project is more likely to be a success. This is unsurprising: the function of project preparation is to improve the technical design of the project and thereby raise its rate of return. Now consider how this might interact with divergent interests. As the expected rate of return on the project is increased, this should tend to widen the performance gap between governments with coincident and divergent interests. The government with interests coincident with those of the donor has an enhanced incentive to implement the project well if the expected rate of return is higher. In contrast, a government with widely divergent interests has no intrinsic interest in the success of the project and so its performance will be unaffected by an increase in the rate of return. Hence, we would expect that the interaction between project preparation and the dummy for divergent interests would be negative.[7]

Now consider the interaction between divergent interests and project supervision. The prediction of the theory developed in Section 2 is that this interaction should be positive. Indeed, were the dummy variable fully to capture the cases in which interests were divergent, the direct effect of project supervision would become insignificant since with coincident interests the donor does not need the information that supervision provides.

These predictions are supported by our results. The interaction of divergent interests and project preparation is negative, although insignificant, and that with project supervision is positive and significant. *A fortiori*, the coefficients on the two variables are significantly different from each other.[8] Thus, supervision is differentially effective in situations where interests are divergent, and conversely, where interests are divergent it is supervision, not preparation, that is differentially important.

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[6] When income and the CPIA are dropped from the regression the direct effect of the dummy variable for divergent interests is highly significant.

[7] In terms of the model of Section 2, the issue concerns the cross-derivative of Pr(success) with respect to project preparation and θ. Let better preparation increase the value of the successful project, *v*. We then find that the optimal *b* increases in *v*, as does Pr(success), and $\frac{\partial^2 \Pr(success)}{\partial v \partial \theta} > 0$. Thus, preparation is predicted to have a higher marginal positive impact on the likelihood of project success the more congruent are the interests of *D* and *R*.

[8] The Wald test that the coefficient of « preparation x LICUS » and « supervision x LICUS » are equal gives a statistic of 2.76 ($\chi^2(1)$).

Taking all variables at the mean values for non-LICUS countries, regression 1 of Table 1 estimates the predicted probability of project success at 0.77.[9] At the mean values for LICUS, but excluding the two interaction terms of the LICUS dummy with supervision and preparation, the probability falls drastically to only 0.37. The addition of the interaction with supervision raises the probability of success to 0.71, so that the differential effect of supervision is critical. The further addition of the interaction with preparation reduces the success rate to 0.58. Hence, even with the differential supervision effect, in the context of divergent interests projects are problematic.

In Table 1, column 2 we show that this result is robust to the addition of controls for the sector in which the project is undertaken, although supervision interacted with divergent interests is now only marginally significant (p-value=0.105).[10] In column 3 we show that it is also robust to the addition of interactions between the sector and the LICUS dummy, none of which are significant.

These results do not allow for the potential endogeneity of supervision and preparation and so we now instrument for them. IEG collects a wide range of characteristics on projects and several of these characteristics, though uncorrelated with project performance are correlated with supervision and preparation. We also use as instruments some supply-side determinants of the amounts of aid received (Tavares, 2003). Instruments are presented in Appendix 2 and our instrumentation regression is reported in Appendix 3. Because the regression is a probit, it is not possible to conduct the usual Hansen over-identification test. We therefore repeat the regression with a linear probability model so that the Hansen test can be performed. The results satisfy the test.[11] The IV results are shown in Table 2, columns 1 and 2. In column 1 the interaction term between the LICUS dummy and supervision becomes much larger once instrumented. The interaction with preparation remains insignificant and negative and dropping this insignificant term does not change the results.

Preparation and supervision are ordinal variables taking the values one to four. Instrumented as they are in the first two columns of Table 2, they are assumed to be continuous, and a possible bias can derive from that. The remaining columns of Table 2

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[9] Overall, regression 1 of Table 1 has a good predictive power: out of the 2023 observations, only 19.4% are wrongly predicted for a cut-off point equal to 0.5 and 20.1% for a cut-off point of 0.75.

[10] However, a test of joint significance of 'supervision' and 'supervision x LICUS' suggests that the two variables are jointly significant (*p*-value=0).

[11] The Hansen J test are reported at the bottom of Table 2.

explore an alternative way of treating the endogeneity of preparation and supervision through a recursive multivariate probit model. Preparation and supervision are transformed into binary variables (see Appendix 2). Preparation and supervision remain significantly positive. Supervision interacted with the dummy for difficult partnerships loses significance (p-value = 0.15), but the interaction term together with the direct effect of supervision are highly jointly significant (p-value = 0). The last row of Table 2 suggests that the error terms of the four simultaneously estimated equations are correlated.

Since supervision is differentially effective in the context of divergent interests, it might be expected that the management of the World Bank would allocate resources to supervision accordingly. In fact, this is not the case. On the contrary, where interests are most divergent supervision is significantly lower. Table 3 shows some descriptive statistics of the quality of supervision in the context of divergent interests, that is in 'LICUS' countries, and in the context of congruent interests. Supervision is less likely to be satisfactory in countries where donor-government interests diverge. The proportion of projects with unsatisfactory and highly unsatisfactory supervision is significantly higher in the context of divergent interests (p-value=0.002). This is confirmed by simple probit estimations of supervision as a function of the LICUS dummy and some project characteristics (Table 4). The dummy for divergent interests is significantly negative, suggesting that in difficult partnerships the quality of supervision is lower.

There are various possible explanations for such a pattern of behaviour. It might be the case that supervision is more costly in conditions of divergent interests. As discussed in Section 2, this would produce an offsetting effect such that the efficient response of supervision would be *a priori* ambiguous. However, as noted by Kilby (2000), the pay-off to enhanced project success is so large relative to the costs of supervision that this explanation seems implausible. Alternatively, the management of the World Bank might themselves not face sufficiently strong incentives to achieve project success. Staff performance is assessed annually by indicators of performance in that year, most notably the disbursement on loans. The World Bank makes an overall commitment to disburse the IDA money that is provided to it every three years by its OECD members, and this in turn generates annual disbursement targets for the management team in each region. In contrast, because of the long lags between the decision to propose a project to the Board and the eventual performance of the project, incentives actually to abort projects are weak. This encourages a 'culture of disbursement' rather than an emphasis upon project success. Hence, it may be that while some individual managers correctly match a high value of b with a high level of supervision, overall managers are more concerned to avoid evidence that would indicate that disbursements on a project should be suspended.

IV. CONCLUSION

In many situations the precision with which the principal can observe the behavior of an agent can be increased at a cost. Further, the principal often has prior information concerning the degree of divergence of her interests from those of the agent. In this paper we have investigated whether the wider the divergence of interests the more should be spent to increase the precision of observation. In our model we have shown that conditional upon the principal being free to structure the contract so as to discriminate according to prior information about the degree of divergence of interests, greater effort to monitor the agent does indeed have a stronger effect on the likelihood of project success where interests are more divergent. We then apply the model to the situation of donor projects that are implemented by a recipient government. Using World Bank and DAC data on project performance and donor assessments of the degree of congruence of donor-government interests, we have found that, consistent with the theory, supervision is differentially effective in improving the performance of projects where interests are least congruent. However, while this would lead us to expect that the donor would accordingly expend greater effort in supervision in situations of widely divergent interests, in fact donors do the opposite. This suggests that either there are offsetting costs of supervision, or the incentives facing donor management to allocate administrative budgets are not well-aligned with the objective of project success.

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TABLE 1. Probability of success of projects.

Success = 1		Probit	
Preparation	1.008	0.999	1.016
	(11.19)***	(11.01)***	(11.04)***
Preparation x LICUS	-0.137	-0.096	-0.091
	(0.77)	(0.54)	(0.50)
Supervision	1.032	1.027	1.026
	(11.65)***	(11.38)***	(11.29)***
Supervision x LICUS	0.325	0.301	0.332
	(1.74)*	(1.62) (p=0.105)	(1.68)*
Dummy 'LICUS' = 1	-0.568	-0.641	-0.600
	(0.87)	(0.98)	(0.81)
Dummy IDA = 1	0.240	0.210	0.211
	(2.45)**	(2.08)**	(2.08)**
Dummy Investment proj. = 1	0.403	0.374	0.376
	(2.96)***	(2.32)**	(2.32)**
Duration of project	-0.047	-0.049	-0.049
	(2.05)**	(2.07)**	(2.03)**
Ln GDP, initial	0.119	0.099	0.099
	(2.38)**	(1.95)*	(1.95)*
Duration in office of leader	-0.013	-0.014	-0.014
	(3.44)***	(3.70)***	(3.82)***
CPIA	0.298	0.304	0.305
	(4.82)***	(4.82)***	(4.83)***
Sector: Education		0.487	0.610
		(2.21)**	(2.47)**
Education x LICUS			-0.490
			(1.18)
Sector: Energy and Mining		-0.118	-0.098
		(0.60)	(0.46)
Energy and Mining x LICUS			-0.121
			(0.32)
Sector: Environment		-0.426	-0.486
		(1.41)	(1.57)
Environment x LICUS			0.157
			(0.36)
Sector: Financial		-0.089	-0.090
		(0.40)	(0.37)
Financial x LICUS			0.608
			(1.01)
Sector: Information/Com		0.426	0.268
		(1.25)	(0.68)
Information/Com x LICUS			0.179
			(0.41)
Sector: Health, Nutrition, Pop		0.058	0.003
		(0.25)	(0.01)
Health, Nutrition, Pop x LICUS			-0.011
			(0.02)
Sector: Private Sector Developt		0.025	0.027
		(0.10)	(0.10)
Private Sector Dev. x LICUS			0.232
			(0.54)
Sector: Public Sector Govce		-0.023	-0.098
		(0.10)	(0.38)
Public Sector Govce x LICUS			-0.249
			(0.74)
Sector: Rural Sector		-0.057	-0.009
		(0.30)	(0.04)
Rural Sector x LICUS			0.358
			(0.69)
Sector: Social Protection		0.322	0.209
		(1.12)	(0.65)
Social Protection x LICUS			-0.308
			(0.81)
Sector: Transport		0.156	0.214
		(0.74)	(0.92)
Transport x LICUS			-0.354
			(0.69)
Sector: Urban Development		0.156	0.212
		(0.68)	(0.86)
Urban Development x LICUS			-0.456
			(0.87)
Sector: Water Supply & San.		-0.115	-0.040
		(0.50)	(0.16)
Constant	-6.956	-6.768	-6.836
	(12.03)***	(11.54)***	(11.50)***
Observations	2023	2023	2021

TABLE 2. Correcting for the endogeneity of preparation and supervision.

Success = 1	IVPROBIT (1)		Multivariate Probit (2)			
			Equation for:			
	1	2	Success	Supervision	Sup. x LICUS	Preparation
Preparation	2.270	2.122	1.305			
	(2.62)***	(2.76)***	(9.02)***			
Preparation x LICUS	-1.114					
	(0.44)					
Supervision	1.039	1.081	1.511			
	(1.19)	(1.29)	(9.32)***			
Supervision x LICUS	5.807	4.842	0.285			
	(1.67)*	(1.85)*	(1.43) (*p*-value= 0.15; joint *p*-value=0.000)			
Dummy IDA = 1	0.270	0.281	0.248	0.054	0.101	0.003
	(1.88)*	(2.08)**	(2.55)**	(0.58)	(0.42)	(0.03)
Dummy Investment proj. = 1	0.233	0.243	0.341	-0.182	0.152	0.127
	(1.02)	(1.11)	(2.59)**	(1.41)	(0.50)	(0.98)
Duration of project	0.066	0.063	-0.026	-0.092	-0.129	-0.107
	(1.41)	(1.41)	(1.08)	(4.52)***	(2.80)***	(4.97)***
Dummy 'LICUS' =1	-12.770	-13.149	-0.263	-0.013	6.865	-0.063
	(1.70)*	(1.84)*	(1.47)	(0.13)	(0.07)	(0.63)
Ln GDP, initial	0.104	0.113	0.133	-0.035	-0.019	0.049
	(1.37)	(1.63)	(2.80)***	(0.69)	(0.12)	(0.92)
Duration of leader in office	-0.010	-0.010	-0.011	-0.005	-0.013	0.002
	(1.66)*	(1.73)*	(2.91)***	(1.41)	(1.23)	(0.55)
CPIA	0.210	0.235	0.272	0.023	0.087	0.072
	(1.87)*	(2.56)**	(4.41)***	(0.43)	(0.64)	(1.25)
Constant	-10.620	-10.460	-3.495	2.141	-3.682	2.407
	(6.03)***	(6.28)***	(7.46)***	(1.50)	(0.04)	(1.64)*
Total multilateral budget				-0.000013	-0.0001	-0.0001
				(0.18)	(0.64)	(0.93)
Total aid budget of USA x				-0.0000	0.0000	-0.000
Distance from Washing.				(0.74)	(0.84)	(0.80)
Dummy capacity = 1				0.183	0.102	0.208
				(2.43)**	(0.60)	(2.64)***
Distance from Tokyo				-0.00004	-0.000	-0.0001
				(1.93)*	(0.13)	(4.07)***
Total aid budget of Japan x				0.0000	0.0000	0.00000001
Distance from Tokyo				(1.09)	(0.30)	(2.77)***
Total aid budget of France x				-0.0001	-0.0001	-0.00004
Same language as France				(4.44)***	(2.23)**	(1.89)*
Total aid budget of UK x				-0.0003	-0.0003	-0.0002
Same language as UK				(4.85)***	(2.14)**	(2.90)***
Observations	2023	2023	2023			
Hansen J stat (p-value)	0.82	0.84				
Exogeneity test (p-value)	0.00	0.00				
Log-Likelihood			-3010.4			
Probability that all $\rho = 0$			0.000			

(1) Prepa., Sup. and Sup. x LICUS are instrumented (Stata ivprobit command).(2) Prepa., Sup. and Sup. x LICUS are transformed into binary variables (Stata mvprobit command).

TABLE 3. Quality of supervision in LICUS and non-LICUS countries.

In % of rated projects	Divergent interests (LICUS)	Non-divergent interests
Highly satisfactory	3	6
Satisfactory	68	72
Unsatisfactory	27	21
Highly unsatisfactory	2	1
	100	100
Not rated (in % of total)	37	23

Source: IEG, authors' calculations.

TABLE 4. Supervision as a function of project characteristics and dummy LICUS

Supervision	1	2	3	4
Dummy LICUS	-0.152	-0.153	-0.153	-0.154
	(2.00)**	(2.01)**	(1.79)*	(2.01)**
Duration	-0.106	-0.096	-0.106	-0.107
	(6.33)***	(4.74)***	(6.32)***	(6.35)***
Capacity = 1	0.199	0.198	0.199	0.188
	(3.19)***	(3.17)***	(3.18)***	(2.91)***
Investment = 1		-0.107		
		(0.83)		
IDA = 1			-0.0004	
			(0.01)	
NGO = 1				0.105
				(0.68)
Constant	1.191	1.235	1.195	1.195
	(10.72)***	(10.51)***	(11.38)***	(11.74)***
Observations	2023	2023	2023	2023

Probit estimations. Supervision is transformed into a binary variable (Appendix 1).

APPENDIX 1

a) Proofs of the results in Section 2

D's problem can be written as

$$(1) \qquad \max_{b,\varepsilon} E_\mu[a^* \cdot 1 - (1-b)c - \mu a^* \cdot bc] - C(\varepsilon;\theta)$$

$$(2) \qquad \text{s.t.} \qquad a^* \in \arg\max_a \; a\cdot\theta + (1-b)c + \mu a \cdot bc - \gamma a^2$$

$$(3) \qquad b \in [0,1]$$

where (2) denotes *R*'s incentive compatibility constraint. *R*'s optimal effort level is then given by

$$(4) \qquad a^* \equiv a(b,\theta,\mu) = \frac{\theta + \mu bc}{2\gamma},$$

such that *D*'s problem becomes

$$(5) \qquad \max_{b,\varepsilon} E_\mu\left[\frac{\theta+\mu bc}{2\gamma} - (1-b)c - \mu\cdot bc\cdot\frac{\theta+\mu bc}{2\gamma}\right] - C(\varepsilon;\theta)$$

$$(6) \qquad = \max_{b,\varepsilon}\left[\frac{\theta + bc - (\theta bc + (1+\varepsilon^{-1})b^2c^2)}{2\gamma} - (1-b)c\right] - C(\varepsilon;\theta)$$

(using $E(\mu)=1$ and $E(\mu^2)=1+\varepsilon^{-1}$).

The first-order conditions are then given by

$$(7) \qquad /b \quad : \quad \frac{c - \theta c - 2(1+\varepsilon^{-1})bc^2)}{2\gamma} + c = 0,$$

$$(8) \qquad /\varepsilon \quad : \quad \frac{\varepsilon^{-2}b^2c^2}{2\gamma} - \frac{\partial C(\varepsilon;\theta)}{\partial\varepsilon} = 0.$$

From (7), we get that[12]

$$(9) \qquad b^* = \frac{(1-\theta+2\gamma)\varepsilon}{2c(1+\varepsilon)},$$

which implies Proposition 1. Plugging (9) into (8), the following condition for optimal precision ε^* is obtained:

$$(10) \qquad \frac{\partial C(\varepsilon^*;\theta)}{\partial\varepsilon}(1+\varepsilon^*)^2 = \frac{(1-\theta+2\gamma)^2}{8\gamma}.$$

---

[12] We assume that γ takes a value such that $a^* \in [0,1]$ and $b^* \in [0,1]$. In particular, this means that we require $\gamma \le \frac{2c(1+\varepsilon)-\varepsilon(1-\theta)}{2\varepsilon}$.

(It is easy to verify that the second-order conditions for a maximum are satisfied).

To prove Proposition 2, plug (9) into (4) and take the expectation with respect to μ, to obtain

$$\text{(11)} \qquad \Pr(success) = E_{\mu}[a^*] = \frac{1}{2\gamma}\left[\theta + \frac{(1-\theta+2\gamma)\varepsilon}{2(1+\varepsilon)}\right].$$

Likewise, $V^*(\varepsilon,\theta)$ as defined in the text can easily be found and is given by

$$\text{(12)} \qquad V^*(\varepsilon,\theta) = \frac{1}{2\gamma}\left[\theta + \frac{\varepsilon(1-\theta+2\gamma)(1-\theta-2\gamma)}{4(1+\varepsilon)}\right] + \frac{(1-\theta+2\gamma)\varepsilon}{2(1+\varepsilon)} - c.$$

From this, we obtain

$$\text{(13)} \quad \frac{\partial \Pr(success)}{\partial\theta} = \frac{1}{2\gamma}\left[1 - \frac{\varepsilon}{2(1+\varepsilon)}\right] > 0;$$

$$\text{(14)} \quad \frac{\partial \Pr(success)}{\partial\varepsilon} = \frac{1}{2\gamma}\left[\frac{(1-\theta+2\gamma)}{2(1+\varepsilon)^2}\right] > 0;$$

$$\text{(15)} \quad \frac{\partial^2 \Pr(success)}{\partial\theta\partial\varepsilon} = \frac{1}{2\gamma}\left[-\frac{1}{2(1+\varepsilon)^2}\right] < 0;$$

$$\text{(16)} \quad \frac{\partial V^*(\varepsilon,\theta)}{\partial\theta} = \frac{1}{2\gamma}\left[1 - \frac{\varepsilon(1-\theta)}{2(1+\varepsilon)}\right] - \frac{\varepsilon}{2(1+\varepsilon)} > 0;$$

$$\text{(17)} \quad \frac{\partial V^*(\varepsilon,\theta)}{\partial\varepsilon} = \frac{1}{2\gamma}\left[\frac{(1-\theta+2\gamma)(1-\theta-2\gamma)}{4(1+\varepsilon)^2}\right] + \frac{(1-\theta+2\gamma)}{2(1+\varepsilon)^2} > 0;$$

$$\text{(18)} \quad \frac{\partial^2 V^*(\varepsilon,\theta)}{\partial\theta\partial\varepsilon} = -\frac{1}{2(1+\varepsilon)^2}\left[\frac{(1-\theta+2\gamma)}{2\gamma}\right] < 0;$$

((16) holds because of the assumption that $\gamma \leq \frac{2c(1+\varepsilon)-\varepsilon(1-\theta)}{2\varepsilon}$; (17) holds as the expression attains its minimum at $\theta = 1$, and its minimal value is given by $\frac{\gamma}{2(1+\varepsilon)^2} > 0$.)

Finally, Proposition 3 follows from standard comparative statics results (see for instance Athey, Milgrom and Roberts 1998). $\arg\max_{\varepsilon} \pi(\varepsilon;\theta)$ is non-increasing in θ if and only if $\pi(\varepsilon;\theta) = V^*(\varepsilon;\theta) - C(\varepsilon;\theta)$ has decreasing differences in $(\varepsilon;\theta)$, which in this context means that $\frac{\partial^2 \pi}{\partial\theta\partial\varepsilon} = \frac{\partial^2 V^*}{\partial\theta\partial\varepsilon} - \frac{\partial^2 C}{\partial\theta\partial\varepsilon} \leq 0.$

b) Two-dimensional contracts

We will now briefly explore what happens if the contract proposed by *D* can contain a fixed component as well as a variable component (based on whether p=1); in other words, we allow for two-dimensional contracts and not just one-dimensional ones as in the main part of the paper.

Formally, *D* now proposes a contract $(f, \tilde{b}, \varepsilon)$, where *f* is a fixed payment that *R* receives as soon as accepting the contract (like *(1-b)c* in the main part of the paper), $\tilde{b}$ is the 'bonus' he receives if p=1 (corresponding to *bc* in the main part), and ε is precision. It is assumed that these two payments together must at least cover the cost of the project, *c*.

As we did in the main part, we will assume that *R*'s participation constraint is satisfied, such that *D*'s problem can now be written as

$$\text{(19)} \qquad \max_{b,\varepsilon} E_\mu[a^* \cdot 1 - f - \mu a^* \cdot \tilde{b}c] - C(\varepsilon;\theta)$$

$$\text{(20)} \qquad \text{s.t.} \qquad a^* \in \arg\max_a \; a \cdot \theta + f + \mu a \cdot \tilde{b}c - \gamma a^2$$

$$\text{(21)} \qquad f + \tilde{b} \geq c$$

It is obvious that (21) must bind at the optimum, as otherwise it would be profitable for *D* to reduce *f* (which would increase her profit without affecting *R*'s effort decision). Thus, $f^* = c - \tilde{b}^*$.

Solving for *R*'s optimal effort decision and substituting it into (19), we can then rewrite the problem as

$$\text{(22)} \qquad \max_{b,\varepsilon} E_\mu \left[\frac{\theta + \mu\tilde{b}}{2\gamma} - (c - \tilde{b}) - \mu\tilde{b} \cdot \frac{\theta + \mu\tilde{b}}{2\gamma} \right] - C(\varepsilon;\theta).$$

This is identical to (5) except that $\tilde{b} = bc$; thus, $\tilde{b}^* = b^* c = \dfrac{(1-\theta+2\gamma)\varepsilon}{2(1+\varepsilon)}$, and all the other results remain the same. Note that $\tilde{b}^*$ is independent of *c*, as *R*'s effort choice and *D*'s benefit from a successful project are both independent of *c*.

Yet, there is a caveat to this analysis: the assumption that the recipient's participation constraint is satisfied is no longer innocuous. *R*'s ex-ante expected utility from a contract $(f, \tilde{b}, \varepsilon)$ equals $f + E_\mu\left[\dfrac{(\theta + \mu\tilde{b})^2}{4\gamma}\right]$, which must be bigger or equal to *R*'s outside option (which we assumed to equal zero) to induce participation. However, with the optimal contract derived above, $f^* = c - \tilde{b}^* = c - \frac{(1-\theta+2\gamma)\varepsilon}{2(1+\varepsilon)}$ could be negative for small c, which could in turn lead to a negative expected utility for some parameter values and thus to a rejection of the contract. Thus, the equivalents of Proposition 1-3 remain valid without further assumptions only if $c \geq \bar{c}(\theta)$. As ex-ante expected utility increases in θ, the lowest threshold value is $\bar{c}(0)$, which can be shown to equal $\frac{(1+2\gamma)\varepsilon}{2(1+\varepsilon)}\left(1-\frac{1+2\gamma}{8\gamma}\right)$.

APPENDIX 2. DATA AND VARIABLES

Success of the project:
Defined according to the 'Outcome' variable which assesses the extent to which the project's major relevant objectives were achieved, or are expected to be achieved, efficiently (Source: made available by IEG). Outcome is assessed on a 6-point scale: highly satisfactory (6), satisfactory, moderately satisfactory, moderately unsatisfactory, unsatisfactory and highly unsatisfactory (1). 'Success' is a dummy variable equal to one for the three highest ratings of outcome.

Preparation:
This variable assesses the government / implementing agency performance in the preparation of the project. It considers specifically whether the government / implementing agency took account of economic, financial, technical, policy, and resource considerations, and ensured participation of major stakeholders in preparing the project (Source: made available by IEG). It is rated on a 4-point scale: highly satisfactory (4), satisfactory, unsatisfactory, highly unsatisfactory (1). When this variable is transformed into a binary variable, it is equal to one when preparation is highly satisfactory and satisfactory, and zero otherwise.

Supervision:
This variable assesses the extent to which services provided by the World Bank supported implementation through appropriate supervision (Source: IEG). Two kinds of factors are considered to assess supervision. The first set of factors focus on development impact (timely identification of problems, appropriateness of solutions, effectiveness of World Bank supervision actions), while the second set of factors refers to the adequacy of supervision inputs and processes (adequacy of supervision resources, reporting quality, attention to fiduciary aspects). Each factor is rated as follows: (i) high (Bank performed all supervision actions with no shortcomings); (ii) substantial (Bank performed supervision actions generally well but with some shortcomings); (iii) modest (Bank supervision had major shortcomings); negligible (Bank largely failed to perform supervision). Overall supervision is rated on a 4-points scale: highly satisfactory (the project was rated at least 'substantial' on all factors, and 'high' on some), satisfactory (the project was rated at least 'substantial' on most factors), unsatisfactory (the project was rated less than 'substantial' on most factors), highly unsatisfactory (the project was rated 'negligible' on most factors). When this variable is transformed into a binary variable, it is equal to one when supervision is highly satisfactory and satisfactory, and zero otherwise.

IDA: is a dummy variable equal to one if the project is financed by IDA and zero if it is financed by IBRD (Source: IEG).

Investment: Dummy variable referring to the type of lending instrument. Lending instruments can be either 'investment' (dummy equals one) or 'adjustment' (dummy equals zero) (Source: IEG).

Duration: duration of the project. This variable corresponds to the duration between the starting date of the project (signature) and the original closing date of the project (Source: IEG).

GDP: Logarithm of initial GDP per capita (in constant dollars) (Source: WDI, 2004).

Duration leader in office:
Number of years the national leader had been in office. '0' indicates transition year. Source: Gurr, Harff and Marshall (2003) and Bienen and van de Walle (1991).

CPIA: Country Policy and Institutional Assessment. It has 20 equally weighted components, divided into four categories (6-point scale): (1) Macroeconomic management and sustainability of reforms; (2) Structural policies for sustainable and equitable growth; (3) Policies for social inclusion; (4) Public sector management. The initial value of the CPIA is introduced (starting year of the project). Source: made available by the World Bank.

LICUS countries:
Dummy equals to one when the CPIA (averaged over the duration of the project) is less than 3 and when the country was a LIC for at least one year during the project (Source: World Bank).

Instruments for supervision and preparation:

Characteristics of the projects:

Cofinancing: dummy variable equal to one when donors have been approached for additional financing (Source: made available by IEG).

NGO: dummy variable equal to one when a non-governmental organisation has participated to the project (Source: made available by IEG).

Capacity: dummy variable equal to one if there is a percentage of the project commitment amount that contributes to knowledge capacity building (Source: IEG).

Distance and supply-side variables:

Same language as donor i : dummy taking the value of one if the donor country and the recipient country share a common language [from Collier, Hoeffler and Pattillo (2004), source: CIA factbook (2003)].

Same religion as donor i : dummy variable taking the value of one if 30 percent or more of the population belong to one religious group in the donor as well as in the recipient country [from Collier, Hoeffler and Pattillo (2004), source : Barrett (1982)].

Distance from capitals: it is measured as the inverse of the distance in kilometres between the capitals of the recipients and Washington D.C., Tokyo and Brussels [Collier, Hoeffler and Pattillo (2004), source: data made available by the World Bank]

Total aid budget of donor i: total net disbursements of ODA by donors *i*, in constant prices 2001 (*i* = France, Germany, Japan, UK, USA, total multilateral) (Source: OECD http://www.oecd.org/dac/stats/idsonline).

APPENDIX 3. Instrumentation regressions for preparation, supervision and supervision x LICUS (corresponding to column 2 of Table 2).

	Preparation	Supervision	Supervision x LICUS
Dummy capacity = 1	0.029	0.063	-0.006
	(0.73)	(1.56)	(0.32)
Dummy cofinancing = 1	-0.009	0.005	-0.011
	(0.37)	(0.21)	(0.90)
Dummy NGO = 1	0.028	0.041	0.037
	(0.47)	(0.68)	(1.38)
Distance from Tokyo	-0.00004	-0.00002	0.000002
	(3.17)***	(1.38)	(0.27)
Distance from Brussels	-0.00004	-0.00001	-0.00001
	(2.14)**	(0.39)	(0.63)
Total multilateral budget	-0.000003	0.00005	-0.00001
	(0.08)	(1.30)	(0.52)
Total budget of aid, France	0.00004	-0.00005	-0.00003
	(0.43)	(0.52)	(0.58)
Total budget of aid, Germany	-0.00001	0.00002	0.00001
	(0.20)	(0.65)	(0.90)
Total budget of aid, Japan	-0.00009	-0.00002	0.00002
	(1.92)*	(0.43)	(0.80)
Total budget of aid, UK	0.0001	0.0001	-0.00003
	(0.39)	(0.53)	(0.29)
Total budget of aid, USA	0.0000	0.0000	0.0000
	(0.17)	(1.01)	(1.67)*
Total aid budget of USA x	0.0000	0.0000	0.0000
Distance from Washing.	(0.64)	(1.33)	(1.29)
Total aid budget of Japan x	0.000000004	0.0000	0.0000
Distance from Tokyo	(2.40)**	(0.65)	(0.12)
Total aid budget of UK x	0.0000	0.0000	0.0000
Distance from Brussels	(0.76)	(0.46)	(0.17)
Total aid budget of France x	0.0000	0.0000	0.0000
Distance from Brussels	(0.95)	(0.17)	(0.08)
Total aid budget of France x	-0.00001	-0.00003	-0.00001
Same language as France	(1.88)*	(3.55)***	(1.71)*
Total aid budget of UK x	-0.00006	-0.00009	-0.00002
Same language as UK	(2.90)**	(4.02)***	(1.96)**
Total aid budget of UK x	0.00004	0.0000	0.0000
Same language as Germany	(1.47)	(0.76)	(0.32)
Dummy IDA =1	-0.001	0.010	-0.003
	(0.03)	(0.27)	(0.16)
Dummy Investment =1	0.028	-0.095	0.021
	(0.59)	(1.96)*	(0.94)
Duration	-0.039	-0.041	-0.013
	(4.86)***	(5.01)***	(3.44)***
Dummy 'LICUS' = 1	-0.038	-0.037	2.715
	(0.98)	(0.92)	(150.2)***
Ln GDP p.c., inital	0.027	-0.011	-0.006
	(1.29)	(0.52)	(0.60)
Duration of leader in office	0.001	-0.002	-0.001
	(0.95)	(1.06)	(0.90)
CPIA, initial	0.040	0.006	-0.002
	(1.82)*	(0.27)	(0.17)
Constant	3.197	2.753	0.372
	(5.20)***	(4.37)***	(1.30)
Observations	2023	2023	2023

Some instruments were dropped because of colinearity (e.g. Distance from Washington).