

HIERARCHICAL CONTRACTING IN GRANT DECISIONS:
EX-ANTE AND EX-POST EVALUATION IN THE CONTEXT OF
THE EU STRUCTURAL FUNDS

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Hierarchical contracting in grant decisions: ex-ante and ex-post evaluation in the context of the EU Structural Funds.*

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Abstract

This paper presents a simple principal-supervisor-agent model of the investment game between a supranational player (the principal), such as the European Commission, a regional government (the supervisor), and a private firm (the executing agency). The EC is a benevolent social welfare maximizer, the regional government has an objective function that combines private benefits to politicians and the welfare of their constituency, the agent is a utility maximizer. The latter can be of a high or low efficiency type, and the operative cost, observable ex post, depends upon this binary technology and managerial effort, also unobservable. The EC offers a matching capital grant to the firm (as it does with the EU Structural Funds), intended to cover part of the investment cost of an otherwise unprofitable project. The regional government offers the remaining share of the subsidy. If the firm claims to be inefficient, the EC can send with some probability an ex-post evaluator and there is a penalty if she discovers that it is of the efficient-type. Moreover the regional government can collaborate with the EC to disclose additional information it may have on the firm, but it needs to be given a reward not to collude with the firm, that is in turn willing to offer a private benefit to the regional government to conceal unfavorable evidence. We show that the role of these providers of additional information is essential to reducing the value of the grant and in improving

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the inefficiencies caused by asymmetric information at the grant decision stage. The paper suggests that the EC should include ex-post evaluation, currently provided by the Structural Funds regulations, within regional planning contracts for infrastructure investment; and that regional governments should be offered a reward for disclosing additional information on the firm technology (ex-ante supervision).

Keywords: Hierarchical contracting, evaluation, EU Structural Funds

JEL codes: D82, H77,R58

1 Introduction.

In this paper we discuss public investment decisions in a multi-level government context. In many countries and federations, regional development policy competencies, including the funding of infrastructure, are decentralized and partly distributed between different levels of decision-making. For example, in Italy the infrastructure decision-making structure is significantly regionalized and national and regional public funds should be matched. The partial decentralization of investment decision applies also at the supra-national level, such as the case of the European Union (EU) Structural Funds (SF), which involves a range of actors and coordination mechanisms between the European, national and (sub) regional level (European Commission [2004]) . Moreover, the implementation of regional development tasks (e.g. education programmes, transport projects,) often involves several actors, including quasi-government bodies, evaluators/auditors and private firms. In this complex environment, the policy decision maker acting as a principal, the one who often offers most of the investment funds as a grant, cannot simply rely on hierarchies and command to efficiently implement their objectives. There is a need to provide incentives to stimulate adequate effort by different agents. Information asymmetry, rents and incentives are the key analytical concepts in this multi-principal multi-agent context when there are co-financing decisions to be taken, and when governments use ex-ante and ex-post evaluation of investment decisions. The paper offers a simple analytical framework to describe the investment game in this context. We focus on the EU case because it offers a common investment policy framework shared by its 27 members states, and because of the substantial amount of finance involved in the operations of the SF, but we think our model has a more general interest, because it applies to a large set of investment co-financing schemes.

First, we assume that the European Commission, acting on behalf of the EU, is a benevolent social planner. The assumption, we think, is justified by the fact that the

EC is fairly independent from elected governments of the Member States, because of its special composition and voting mechanism. This makes it difficult for a majority coalition with a private agenda to capture the EC. The EC has a mandate by the EU to implement a regional development policy, including a budgetary allocation to offer regional governments grants that are targeted to co-funding of infrastructure and other public investment. Second, regional governments, in contrast with the EC, are elected bodies. They have an objective function that combines social welfare maximization and the private agenda of the policy-makers. We do not assume that all regional governments are prone to corruption, but we consider realistic to think that policy makers across the EU regions are, to a certain extent, self interested (with wide national/regional variations), see Laffont (2005) for regulatory mechanisms in developing countries under governments with a private agenda. Third, the investment implementing agency can be seen as a firm under the control of a utility-maximizer manager. This is obvious when the firm is under private ownership, and just a simplification of the model when the firm is fully or partly government-owned. Fourth, there is an independent ex-post evaluator, acting loyally on behalf of the EC.

The game is as follows. The regional government identifies a socially deserving project, that is however unprofitable without a public subsidy. The EC offers a matching grant to the regional government, who needs to cover the difference between the SF grant and the investment cost. There are two technologies available to the implementing firm. If the firm claims that it has access to the less efficient technology, i.e. the investment cost is higher than otherwise, the EC may send an ex-post evaluator. If the evaluator discovers that the firm has lied, because in fact it had access to the superior technology, there will be a penalty. Moreover, the EC can offer the regional government a reward for ex-ante evaluation and to avoid collusion between the firm and the self-interested policy makers. We determine the optimal amount of ex-ante and ex-post evaluation that solves the asymmetric information problem of the European principal. The policy implication of the paper is that information providers have a crucial role in minimizing rents that accrue to firms and to self-interested policy makers, and that a well designed ex-ante and ex-post evaluation mechanism should be an essential ingredient of co-funding of infrastructure in a multi-government setting.

The paper has the following structure. Section 2 offers some background information on the EU Structural Funds context and our research motivation. Section 3 presents our model, and Section 4 concludes.

2 Infrastructure co-financing under the EU Structural Funds

2.1 Overview

In the coming years the EU institutions, national governments, regional managing authorities, public and private companies will be involved in a huge investment planning game. In 2007-2013 the EU Structural Funds will contribute with matching grants to the infrastructure plans of 27 countries, including ten new members (mostly former transition economies) and the two new recently accessed countries (Romania and Bulgaria). IPA funds will assist Croatia and other accession candidates. The EU seven-years budget supporting this effort will draw from a provision of over EUR 300 billion for Cohesion policy. Table 1 shows the Cohesion Policy Budget, eligibility, priorities and allocations.

A substantial part of the funds is going to be allocated to infrastructure projects, in regions lagging behind in their endowment of basic stock of capital compared to the rest of the EU. Moreover, there will be a leverage effect of the EU funds on public and private finance, because in most cases Brussels will contribute only a part of the cost, and the rest of capital expenditure must be matched by other sources of finance. Table 2 shows the sources of co-financing for selected countries and years.

Some authors have taken a highly critical attitude about the impact of these EU funding mechanisms, and have even proposed a discontinuation of the Structural Funds. The Sapir Report (Sapir et al, 2004) has proposed a wide reform, which in fact amounts to concentrating available EU resources on the new Member States, and to entirely delegating the project planning to them. However, a re-nationalization of regional policy has been rejected by the EU, because it is widely acknowledged that the EC is in a unique position to capitalize infrastructure knowledge across countries and regions. This learning mechanism has an intrinsic value, that will be entirely lost by full re-nationalization of planning and evaluation (Florio,2005). The core of the potential added value of a co-financing mechanism for infrastructure investment lies, in fact, in its information/incentive structure, when there is ex-ante and ex-post evaluation. We show however that a more formal link between co-financing, investment and evaluation is needed to exploit the above mentioned potential.

In the rest of this section we briefly present some institutional features of EU infrastructure funding: grants by the Structural Funds and the Cohesion Fund, which are the key-mechanisms managed by the European Commission, and the role of evaluation.

Table 1

Use of Structural funds in 2000-06 period by Objective and field of intervention (%)

Programmes and instruments	Eligibility	Priorities	Allocations
Convergence objective			81.7 % (EUR 251.330 billion) <i>including the special programme for the outermost regions</i>
National and regional programmes (ERDF, ESF)	Regions with per capita GDP < 75 % of EU-25 average	<ul style="list-style-type: none"> • Innovation • Environment • Accessibility • Human Resources • Infrastructures • Administrative Capacity 	70.5 % = EUR 177.29 billion
Cohesion Fund	Member States with per capita GNI < 90 % of Community average	<ul style="list-style-type: none"> • Transport networks (TEN-T) • Sustainable transport • Environment • Renewable energy 	5% = EUR 12.52 billion
Regional competitiveness and employment objective			15.8 % (EUR 48.789 billion)
Regional programmes (ERDF) and national programmes (ESF)	The Member States propose a list of regions (NUTS1 or NUTS2)	<ul style="list-style-type: none"> • Innovation • Environment/risk prevention • Accessibility • European employment • Strategy 	78.7% = 38.404 billion
European territorial cooperation objective	'Phasing in' regions covered by Objective 1 between 2000 and 2006 and not covered by the employment strategy convergence objective		21.3 % = EUR 10.385 billion
Cross-border and transnational programmes and networks (ERDF)	Border regions and large transnational cooperation regions	<ul style="list-style-type: none"> • Innovation • Environment/risk prevention • Accessibility • Culture, education 	2.4 % (EUR 7.5 billion)
Total			35.61 % cross-border cooperation
			12.12 % European neighbourhood and partnership instrument
			47.73 % transnational cooperation
			4.54 % networks
			307,5

Source: European Union Regional Policy, Factsheet 2004: "Cohesion Policy: the 2007 Watershed. Legislative proposal by the European Commission for the reform of the Cohesion Policy (2007-2013 period)", Council of the European Union: "Financial Perspective 2007-2013", p. 8 Brussels, 19/12/2005.

Table 2**Leverage effect of Structural Funds on public and private expenditure under Objective 1, 1994-1999 and 2000-2006 (EUR)**

	1994-1999* National public funds per euro of SF	Private funds per euro of SF	2000-2006 National public funds per euro of SF	Private funds per euro of SF
BE	0.77	1.18	1.02	1.43
DE	0.37	1.53	0.58	0.02
EL	0.52	0.28	0.50	0.48
ES	0.51	:	0.52	0.04
FR	0.54	0.23	0.88	0.33
IE	0.43	0.34	0.76	0.25
IT	1.40	:	0.89	0.45
NL	2.49	1.42	2.15	0.55
AT	1.59	3.79	0.33	1.76
PT	0.42	0.30	0.60	0.46
UK	0.53	0.24	0.85	0.43
Total	0.62	0.36	0.63	0.29
EU11				

Notes: * based on actual expenditure 1994-2000 ES, IT: for 1994-1999, national public funds include private funds; EU11: excluding FI, SE

Source: *Third report on economic and social cohesion: A new partnership for cohesion convergence competitiveness cooperation. Statistical Annex to Part 4: Impact and added value of structural policies, p.180, EC, 2004.*

2.2 Grant mechanisms: The Structural Funds and the Cohesion Fund

The EU Structural funds are financial instruments that offer Community assistance, in the form of capital grants, to different kinds of regional programmes and project. Table 3 shows some figures from the previous planning period (2000-2006).

In the framework of the 2007-2013 Cohesion Policy there are three main objectives. The first one, and by far the most important in terms of funds available under the Cohesion Policy (around 82%), is the objective of supporting the convergence of sustainable economic growth in the regions lagging behind. Most of these regions are located in the new Member States, but there are many relatively under-developed regions in some rich countries in the former EU-15, particularly in Italy (the Mezzogiorno), in Germany (the Eastern Laender of the former DDR), in Spain, Greece, Portugal, in the overseas French islands, and elsewhere. A second objective is to increase the competitiveness and employment outlook in some of the remaining regions. Many of them, while located in the core areas of Europe, face high unemployment and relatively modest growth. Third, there is an objective of territorial cooperation that is of some relevance for regions facing trans-boundary problems and in some specific geographic conditions.

EU assistance to achieve these objectives revolves around a small number of financial instruments, each with a set of operating rules, eligibility conditions, co-financing rates, etc. The most important of these funds is the European Regional Development Fund (ERDF).

In the Convergence regions, defined as those where GDP per capita is below the threshold of 75% of the EU average in terms of purchasing power standard Euro, the ERDF has a very wide range of possible intervention areas¹.

Eligible investment projects in the Competitiveness regions are more focused on three priorities: innovation and the knowledge economy, environment and risk protection, and accessibility (transport and TLC). Under the Territorial Cooperation objective, the priorities are cross-border, joint development programmes, trans-national

¹These include inter alia: research and development, innovation and entrepreneurship, development of business clusters, support to SMEs; information society projects, including adoption of ICTs by small and medium enterprises; environmental projects, including water, waste management, air quality, rehabilitation of contaminated land, pollution-preventing technologies; natural and technological risk prevention; promotion of sustainable tourism and enhancement of the cultural heritage; transport investment (rail, highways, ports, airports), including the trans-European networks and clean urban transport; energy investment (electricity and gas, etc) including the trans-European networks; education infrastructures; health infrastructures; direct aid to investment of SMEs for job creation or safeguard of existing employment.

cooperation in infrastructure for accessibility and the environment, and networking of regions. There are also specific provisions for urban and rural areas, and for some areas with particular natural handicaps.

While the ERDF is in a broad sense targeted at infrastructure and productive investment, the European Social Fund is mainly concerned with human capital, including support to vocational training and education programmes of different nature, public or private.

Lastly, the Cohesion Fund was established in 1993 under the Maastricht Treaty to promote economic and social cohesion and solidarity between EU Member States. It funds projects in the field of environment and Trans-European transport infrastructure networks. The rationale for establishing the CF was that the least prosperous Member States should be helped to invest heavily to strengthen their growth potential. Member States eligible for CF assistance are those whose per capita gross domestic product (GDP) measured in purchasing power parity is less than 90% of the EU average. These countries originally were Greece, Portugal, Ireland and Spain. As from 1 May 2004, the new EU Member States are all eligible, and they will receive around EUR 8.5 billion until 2006. The total CF budget for 2000-06 amounts to EUR 18 billion (1999 prices) for EU 15.

As for the 2007-2013, the CF is one of three funds, out of the previous six, that remain as instruments for the convergence objectives. This will include Greece, Portugal, Spain, the current ten new members plus Romania and Bulgaria. Eligible investment projects will include Trans-European transport networks, sustainable transport, environment, and renewable energy.

Ceilings for EU- co-financing are different according the region and the fund (the overall cap at national level for EU grants is 4% of GDP per year). Moreover, ERDF finance, in form of a grant, can be combined with loans by the EIB, and with other sources of finance.

In this paper we particularly have in mind revenue generating projects. According to Art. 55 of the regulation, these are defined as " any operation involving an investment in infrastructure the use of which is subject to charges born directly by users or any operation involving the sale or rent of land or buildings or any other provision of service against payment". For these projects the EC contributes to filling the gap between the present value of investment costs and the present value of the net revenues. For example, if over a given time horizon and for a given discount rate, the present value of the investment cost of a tolled highway is 100, but the present value of its revenues net of operative costs is just 80, there is a financing gap of 20. Based

on a cost-benefit-analysis (CBA) that offers evidence that the economic net present value (i.e. using shadow prices for the time savings of users) is positive, the EC can take a decision to fill part of the financing gap with a grant, while the remaining part of the financing gap is to be filled by the regional or national public body that is responsible for the infrastructure investment.

2.3 Evaluation.

Project selection and ex-ante evaluation within this very broad framework is normally the sole responsibility of the national authorities. However for very large projects (with a total investment cost of more than EUR 50 million, or 25 for environmental projects), the EC requires Member States to submit a cost-benefit analysis (CBA) and then takes a specific co-financing decision, Florio (2006a, 2006b).

The new legal base for CBA of investment project funded within the cohesion policy is given by art. 40 “Information submitted to the Commission”, Council Regulation (EC) No 1083/2006 that states that:

“The Member State or the managing authority shall provide the Commission with the following information on major projects:

- a) information on the body to be responsible for implementation;
- b) information on the nature of the investment and a description of it, its financial volume and location;
- c) the results of the feasibility studies;
- d) a timetable for implementing the project and, where the implementation period for the operation concerned is expected to be longer than the programming period, the phases for which Community co-financing is requested during the 2007-2013 programming period;
- e) a cost-benefit analysis, including a risk assessment and the foreseeable impact on the sector concerned and on the socioeconomic situation of the Member State and/or the region and, when possible, of the other regions of the Community;
- f) an analysis of the environmental impact;
- g) a justification for the public contribution;
- h) the financing plan showing the total planned financial resources and the planned contribution from the Funds, the EIB, the EIF and all other sources of Community financing, including the indicative annual plan of the financial contribution from the ERDF or the Cohesion Fund for the major project.

Table 3
Use of Structural funds in 2000-06 period by Objective and field of intervention (%)

	Objective 1	Objective 2	Objective 3
1 Productive Environment	34.96	55.83	0.55
1.0 Productive Environment	0.06	0.06	0
1.1 Agriculture	14.55	0.22	18.95
1.2 Forestry	3.35	0.08	19.47
1.3 Promoting the adaptation and the development of rural areas	18.58	4.14	0.53
1.4 Fisheries	5.50	0.16	0.53
1.5 Assisting large business organizations	7.76	4.21	4.17
1.6 Assisting SMEs and large business organizations	27.30	57.51	25.22
1.7 Tourism	8.80	15.81	20
1.8 Research, technological Development and Innovation (RTDI)	14.09	17.80	11.14
2 Human resources	23.27	10.56	97.01
2.0 Human resources	0.28	5.17	0.21
2.1 Labour market policy	30.29	17.29	29.98
2.2 Social inclusion	13.92	18.78	21.96
2.3 Developing educational and vocational training not linked to a specific sector	30.29	19.93	20.08
2.4 Workforce flexibility, entrepreneurial activity, innovation, information and communication technologies	19.83	33.49	20.94
2.5 Positive labour market actions for women	5.39	5.34	6.83
3 Basic Infrastructure	39.54	28.49	0.35
3.0 Basic Infrastructure	0.00	3.08	0
3.1 Transport infrastructure	48.14	20.41	0
3.2 Telecommunications infrastructure and information society	9.17	11.31	91.52
3.3 Energy infrastructure	2.50	3.19	0
3.4 Environmental infrastructure	16.36	14.08	0
3.5 Planning and rehabilitation	14.33	44.20	0
3.6 Social and public health infrastructure	9.50	3.74	8.48
4 Miscellaneous	2.23	5.12	2.09
4.0 Miscellaneous	2.23	3.11	0
4.1 Technical assistance and innovative actions (ERDF, ESF, EAGGF, FIG)	88.46	42.66	100
4.9 Miscellaneous	3.59	54.23	0

Source: 16th Annual Report on the implementation of the Structural Funds 2004. Technical annexes, Pp .183-193. Brussels, 28/10/2005

The Commission shall adopt indicative guidance on the methodology to be used in carrying out the cost benefit analysis foreseen in (e) above in accordance with the procedure referred to in Article 104(2)".

In addition to relying on the governments of the Member States to acquire this ex-ante project evaluation, the SF regulations state that the EC is responsible for ex-post evaluation: it can appoint independent experts that after the completion of the project will re-assess its benefits and costs.

In fact, Art 49 of the above mentioned regulation states that: 'The Commission shall carry out and ex post evaluation for each objective in close cooperation with the Member States and managing authorities. Ex post evaluation shall cover all operational programmes under each objective and examine the extent to which resources were used, the effectiveness and efficiency of Fund programming and the socioeconomic impact...'.

Hence, there is a clear provision for ex-ante and ex-post evaluation in the SF regulations, but there is no clear link between the investment co-financing decision and such evaluations. Florio and Vignetti (2006) suggest that without a contractual link between evaluation and co-financing a misallocation of Structural Funds may arise. Occasional observation shows that there may be, however, some informal punishment for regional governments who are thought to having disclosed insufficient information ex-ante (e.g. the co-financing decision by the EC will be delayed) or when ex-post evaluation discovers unsatisfactory outcomes (e.g. loss of reputation of the managing authority). In the next section we suggest a co-financing mechanism that establishes a link between evaluation and investment planning in this context.

3 The model.

3.1 Utility functions and information.

As previously discussed the European Commission wants to finance an indivisible project in one of the member states which is not financially viable without government intervention. The project has an economic rate of return (ERR) that is above some predefined threshold but a low financial rate of return (FRR) that makes the project non profitable for a private firm. A grant covering the difference between revenues and investment plus operating costs would allow the firm to carry out the project without a loss.

Since EU funding are limited the goal of the Commission is to finance projects with

the minimum expenditure necessary, that is the one that guarantees the participation of the firm while maximizing social benefits.

In other words if the return from the projects are given by the operating revenues R we have a situation where, without a grant:

$$R - TotalCosts < 0, \quad (1)$$

while with a grant the total profits become non negative:

$$R + GRANT - TotalCosts \geq 0. \quad (2)$$

We assume the cost function of the firm is given by:

$$\begin{aligned} TotalCosts &= c + K \\ &= \beta - e + K \end{aligned} \quad (3)$$

where K is the cost of capital which is common knowledge, $\beta - e$ is the operating cost which is composed of a firm specific characteristics β that is private information to the firm and an unobservable effort level e which reduces the cost.

For each level of effort e the firm must endure a disutility $\psi(e)$ (where $\psi' > 0$, $\psi'' > 0$).

β is and adverse selection parameter that indicates the level of efficiency of the firm, we assume it can take two values $\bar{\beta}$ and $\underline{\beta}$ with $\bar{\beta} > \underline{\beta}$. It is independently distributed with $\nu = \Pr(\beta = \underline{\beta})$ and the distribution is common knowledge. e is non-negative and is a moral hazard variable which is decided by the firm after the grant has been approved and is also private information to the firm.

The utility function of the firm is:

$$U = R + \tilde{G} - (\beta - e) - K - \psi(e) \quad (4)$$

where as described before R are revenues, \tilde{G} is the grant, $(\beta - e) + K$ are total costs and $\psi(e)$ is the disutility of effort.

The Commission sets the grant with the goal of maximizing social welfare, the grant is financed with distortive taxation which causes a social cost λ . Consumers' net welfare from the project can be written as:

$$V = S - R - (1 + \lambda) \tilde{G} \quad (5)$$

where S is the surplus generated by the project, R is the revenue (paid by consumers) and $(1 + \lambda) \tilde{G}$ is the total cost of the grant.

We assume that total costs and revenues are ex-post observable and we make the accounting convention that the Commission receives the revenues, pays the costs and gives the firm a "net" grant:

$$G = R + \tilde{G} - (\beta - e) - K \quad (6)$$

so that we simplify the expression for the firm's utility function to:

$$U = G - \psi(e). \quad (7)$$

We can also rewrite consumers' net welfare as:

$$\begin{aligned} V &= S - R - (1 + \lambda) [G - R + (\beta - e) + K] \\ &= S + \lambda R - (1 + \lambda) [(\beta - e) + K + \psi(e)] - (1 + \lambda) U \end{aligned} \quad (8)$$

Social welfare is then:

$$\begin{aligned} W &= V + U \\ &= S + \lambda R - (1 + \lambda) [(\beta - e) + K + \psi(e)] - \lambda U. \end{aligned} \quad (9)$$

If the commission knew the true value of β and could observe e then the only constraint she would face is the participation constraint of the firm:

$$U \geq 0 \quad (10)$$

Since giving up rent to the firm is costly (because of the costs of public funds) the above constraint will be binding and the problem the commission would solve in a world of perfect information becomes:

$$\max_e W = S + \lambda R - (1 + \lambda) [(\beta - e) + K + \psi(e)] \quad (11)$$

From the FOC with respect to e we find the first best level of cost reducing effort:

$$\psi'(e^*) = 1 \quad (12)$$

which is that level that equates the marginal disutility of effort with the marginal benefit of effort (the marginal cost reduction effect), while from the binding participation

constraint we obtain the first best grant:

$$\tilde{G}^* = \psi(e^*) + (\beta - e^*) + K - R. \quad (13)$$

3.2 The optimal grant.

As previously assumed the Commission cannot observe e and knows only the probability distribution of β .

We know that the grant can take the form of an optimal revelation mechanism which will apply the standard results of incentive theory.

The grant will be a contract conditional on the revelation of the efficiency parameter. In other words a firm claiming to be efficient, i.e. of type $\underline{\beta}$, will be offered a grant-cost reimbursement pair $\{(\underline{G}, \underline{c})\}$, while a firm which will reveal to be inefficient, i.e. of type $\bar{\beta}$, will be offered a pair $\{(\bar{G}, \bar{c})\}$. This contract is equivalent to the following $\{(\underline{U}, \underline{e}), (\bar{U}, \bar{e})\}$ that specifies, for every type of firm, an ex-post rent and an effort level.

The optimal grant will be designed satisfying two sets of constraints, the participation constraints of the previous section and the incentive compatibility constraints which will ensure the truthful revelation of the efficiency parameter by the firm.

The first set of constraints is:

$$\underline{U} \geq 0 \quad (14)$$

$$\bar{U} \geq 0. \quad (15)$$

Incentive compatibility constraints are:

$$\underline{U} = \underline{G} - \psi(\underline{\beta} - \underline{c}) \geq \bar{G} - \psi(\underline{\beta} - \bar{c}) \quad (16)$$

$$\bar{U} = \bar{G} - \psi(\bar{\beta} - \bar{c}) \geq \underline{G} - \psi(\bar{\beta} - \underline{c}). \quad (17)$$

The above inequalities make sure that an efficient firm will not gain from claiming to be inefficient and receiving the grant designed for the inefficient firm and vice-versa.

Let $\Phi(e) = \psi(e) - \psi(e - \Delta\beta)$ be an increasing and convex function of e .

Rewrite the IC of the efficient firm:

$$\begin{aligned} \underline{G} - \psi(\underline{e}) &\geq \bar{G} - \psi(\underline{\beta} - \bar{\beta} - \bar{e}) + \psi(\bar{e}) - \psi(\bar{e}) \\ \underline{G} - \psi(\underline{e}) &\geq \bar{G} - \psi(\bar{e}) + \Phi(\bar{e}) \\ \underline{U} &\geq \bar{U} + \Phi(\bar{e}) \end{aligned} \quad (18)$$

and the one for the inefficient firm:

$$\begin{aligned}
\bar{G} - \psi(\bar{e}) &\geq \underline{G} - \psi(\bar{\beta} - \underline{\beta} + \underline{e}) + \psi(\underline{e}) - \psi(\bar{e}) \\
\bar{G} - \psi(\bar{e}) &\geq \underline{G} - \psi(\underline{e}) - \Phi(\underline{e} + \Delta\beta) \\
\bar{U} &\geq \underline{U} - \Phi(\underline{e} + \Delta\beta)
\end{aligned} \tag{19}$$

The optimal grant can now be derived by maximizing expected social welfare subject to the incentive compatibility and participation constraints. The program is:

$$\begin{aligned}
&\max_{\{U, \underline{e}, \bar{U}, \bar{e}\}} \nu [S + \lambda R - (1 + \lambda) [(\underline{\beta} - \underline{e}) + K + \psi(\underline{e})] - \lambda U] \\
&+ (1 - \nu) [S + \lambda R - (1 + \lambda) [(\bar{\beta} - \bar{e}) + K + \psi(\bar{e})] - \lambda \bar{U}] \\
&\text{s.t. (14), (15), (18), (19)}.
\end{aligned}$$

In this type of problems the participation constraint of the inefficient firm (15) and the incentive compatibility constraint of the efficient (18) will be binding. We then have:

$$\bar{U} = 0 \tag{20}$$

$$\underline{U} = \Phi(\bar{e}). \tag{21}$$

After substituting the above the optimization problem simplifies to:

$$\begin{aligned}
&\max_{\{\underline{e}, \bar{e}\}} \nu [S + \lambda R - (1 + \lambda) [(\underline{\beta} - \underline{e}) + K + \psi(\underline{e})] - \lambda \Phi(\bar{e})] \\
&+ (1 - \nu) [S + \lambda R - (1 + \lambda) [(\bar{\beta} - \bar{e}) + K + \psi(\bar{e})]]
\end{aligned} \tag{22}$$

From the FOC we obtain the required levels of cost reducing effort:

$$\psi'(\underline{e}^*) = 1 \tag{23}$$

$$\psi'(\bar{e}) = 1 - \frac{\lambda}{1 + \lambda} \frac{\nu}{1 - \nu} \Phi'(\bar{e}). \tag{24}$$

This is a standard solution that requires the efficient firm to carry out the optimal first best level of cost reducing effort while the level of effort required to an inefficient firm is lower than the first best because of the optimal trade-off between efficiency and informational rent.

The grant offered to the two types of firms are the following:

$$\underline{\tilde{G}} = \Phi(\bar{e}) + \psi(e^*) + (\beta - e^*) + K - R \quad (25)$$

$$\tilde{\bar{G}} = \psi(\bar{e}) + (\bar{\beta} - \bar{e}) + K - R \quad (26)$$

and they are both higher than the first best grant, but for different reasons. $\underline{\tilde{G}}$ is higher because the commission pays and informational rent $\Phi(\bar{e})$ to the efficient firm, while $\tilde{\bar{G}}$ is higher because the level of cost reducing effort is inefficiently downward distorted. Asymmetric information between the European Commission and the firm makes project financing more expensive.

3.3 The role of ex-ante and ex-post evaluators.

We now introduce two additional players, the regional government and an ex-post evaluator.

The regional government pays a predefined share of the grant awarded by the Commission and covers a supervisory role. Because of its proximity to the firm the regional government is in fact assumed to have an informational advantage with respect to the Commission. We assume that, before the grant offer is made, the regional government receives a signal σ about the efficiency status of the firm. The regional government is non-benevolent and can be led by the firm into not disclosing information to the Commission in exchange of private benefits.

The ex-post evaluator is instead sent, with some probability, by the Commission after the project has been built. If sent, the auditor will learn, with probability one, verifiable information about the parameter β . We make the further assumption that the ex-post evaluator has no discretion and cannot lie about what he has learned. If the outcome of the valuation is that the firm has lied at a previous stage then there is a fine to pay.

The timing of our game is now the following:

1. the firm learns β ;
2. the regional government learns σ ;
3. the Commission offers two contingent grants;
4. the firm chooses the grant;
5. grant is paid;

6. ex-post evaluator is sent with probability p ;
7. possible fines to be paid.

We will start by studying the effect of the introduction of an ex-post evaluator.

Let p be the probability of sending an ex-post auditor, p^2H the cost of the audit and P the exogenous punishment for the firm if it turns out it lied to the commission².

An optimal grant will now be a pair of triplets $\{(\underline{U}, \underline{e}, \underline{p}), (\bar{U}, \bar{e}, \bar{p})\}$, in other words the offer by the commission will include contingent probabilities of audit together with a rent and effort level.

We will consider the punishment to be exogenous and not too high, so that the participation constraint will be satisfied.

It is worth stressing that there is no need to evaluate a firm claiming to be efficient, because the inefficient's type incentive constraint is slack anyway and auditing is costly. Hence, at an optimum, we necessarily have $\underline{p} = 0$.

The only constraint that needs to be modified is therefore the IC of an efficient firm:

$$\underline{U} = \Phi(\bar{e}) - pP \tag{27}$$

in other words, the benefit from an untruthful report are lowered by the probability of audit and the expected punishment.

The role played by the regional government is instead more complex. As a consequence also the informational rent that needs to be paid to ensure a truthful report is also reduced.

By assumption the signal $\sigma \in \{\emptyset, \underline{\beta}\}$, this means that the regional government either discovers the firm to be efficient or it will learn nothing from the signal. More precisely if $\beta = \underline{\beta}$ the local government observes $\sigma = \underline{\beta}$ with probability ξ and nothing with probability $1 - \xi$. If $\beta = \bar{\beta}$ it does not observe anything.

We make the additional assumption that the signal $\sigma = \underline{\beta}$ is hard information, meaning that it can be hidden but not manipulated.

If the regional government was benevolent then the Commission would be able to offer the first best grant when $\sigma = \underline{\beta}$ and offer the second best contract with updated probabilities $\hat{\nu} = \frac{\nu(1-\xi)}{1-\nu}$ whenever $\sigma = \emptyset$.

We instead assume that the regional government is non benevolent and can be led by the local firm to conceal unfavorable evidence about the efficiency parameter³.

²On delegated random auditing see Faure-Grimaud, Laffont and Martimort [1999] and Laffont and Martimort [2002].

³We model collusion in the spirit of Tirole [1979].

Some private benefits paid by the firm would represent the gain for the regional government.

The firm is to stand losing the informational rent if evidence about $\beta = \underline{\beta}$ is brought forward to the Commission, this amounts to $\Phi(\bar{e}) - pP$. This implies that any payment b that the firm might be willing to offer to the local government has an obvious upper bound:

$$b \leq \Phi(\bar{e}) - pP. \quad (28)$$

The utility function of the regional government is given by the sum of the regional consumer's net surplus plus the private benefit it might receive from the firm:

$$LG = \widehat{S} - \widehat{R} - \alpha(1 + \lambda)\widetilde{G} + kb \quad (29)$$

where \widehat{S} is the change in regional consumer surplus from the project, \widehat{R} is the share of revenues paid by regional consumers, α is the share of the grant that the regional government will have to finance, $(1 + \lambda)\widetilde{G}$ is the total cost of the grant as before, b are private benefits and $k \in (0, 1)$ is the efficiency of collusion. $k \in (0, 1)$ implies that not all the funds spent by the firm arrive in the pockets of the regional government, this may be due to the transaction costs of such not-very-legal activity or to the nature of the goods exchanged.

To avoid collusion in equilibrium the commission will have to pay some contingent transfer m to the local government whenever it reports that the firm is efficient.

The incentive compatibility constraint for the local government is:

$$\widehat{S} - \widehat{R} - \alpha(1 + \lambda)\widetilde{G}^* + m \geq \widehat{S} - \widehat{R} - \alpha(1 + \lambda)\widetilde{G} + kb \quad (30)$$

which ensures that the local government will prefer to report an efficient firm, receive m and pay a share of \widetilde{G}^* instead of hiding evidence, receive kb and pay a share of \widetilde{G} . In other words the Commission must compensate the regional government for its help in the evaluation of the project, in this way truthful reporting about the firm parameters becomes convenient for the regional government.

After a few calculations we find:

$$m \geq k(\Phi(\bar{e}) - pP) - \alpha(1 + \lambda)(\widetilde{G} - \widetilde{G}^*) \quad (31)$$

where $(\widetilde{G} - \widetilde{G}^*)$ is positive and decreasing in e .

So in case the firm is efficient and the regional government finds hard evidence

about that, then the Commission does not pay any informational rent to the firm, instead it pays a transfer to the regional government. The gain for the Commission comes from m being lower than \underline{U} for two reasons:

1. inefficiency of collusion ($k < 1$)
2. cost sharing between the Commission and the regional government (if the firm is efficient also the local government saves on his share of the grant)

Because of the incentives given to regional government to reveal information the solution will be the first best full-information one with probability $\nu\xi$.

More precisely the objective function for the Commission is now:

$$\begin{aligned} & \max_{\{\underline{U}, \underline{e}, \bar{U}, \bar{e}, p\}} \nu\xi [S + \lambda R - (1 + \lambda) [(\underline{\beta} - \underline{e}^*) + K + \psi(\underline{e}^*)] - \lambda m] \\ & + \nu(1 - \xi) [S + \lambda R - (1 + \lambda) [(\underline{\beta} - \underline{e}) + K + \psi(\underline{e})] - \lambda \underline{U}] \\ & + (1 - \nu) [S + \lambda R - (1 + \lambda) [(\bar{\beta} - \bar{e}) + K + \psi(\bar{e})] - \lambda \bar{U} - p^2 H], \end{aligned} \quad (32)$$

this is composed by three elements: with probability $\nu\xi$ the firm is efficient and the regional government observes a meaningful signal therefore the Commission compensates the regional government for its contribution, with probability $\nu(1 - \xi)$ the firm is efficient but the regional government does not observe anything so the firm must be given some rent to reveal its parameters truthfully and finally with probability $(1 - \nu)$ the firm is inefficient so the Commission will send an ex-post evaluator with probability p and will pay the evaluation cost $p^2 H$.

The constraints that the Commission has to satisfy are the following:

$$\bar{U} = 0 \quad (33)$$

$$\underline{U} = \Phi(\bar{e}) - pP \quad (34)$$

$$m = k(\Phi(\bar{e}) - pP) - \alpha(1 + \lambda)(\psi(\bar{e}) + (\beta - \bar{e}) - \psi(\underline{e}^*) - (\underline{\beta} - \underline{e}^*)) \quad (35)$$

From the FOC we obtain the following:

$$\psi'(\underline{e}^*) = 1 \quad (36)$$

$$\psi'(\bar{e}) = 1 - \frac{\lambda}{1 + \lambda} \frac{\nu}{1 - \nu + \alpha\lambda\nu\xi} \Phi'(\bar{e}) [1 - \xi + \xi k]. \quad (37)$$

In other words also when the firm is efficient and the local government does not receive and informative signal (that happens with probability $\nu(1 - \xi)$) the cost reducing effort required is the efficient level, what is different are the costs for the commission

which are now higher because $\underline{U} > m$. The informational rent for an efficient firm is in fact higher than the transfer required to have a truthful report from the regional government.

In case of an inefficient firm the cost reducing level of effort is distorted away from the efficient level, but it is less distorted than in the case without the regional government.

So the grant awarded by the European Commission will be the following contingent plan:

$$\begin{aligned} \text{with probability } \nu\xi & : \tilde{G}^* = \psi(e^*) + (\beta - e^*) + K - R \\ \text{with probability } \nu(1 - \xi) & : \tilde{G} = \Phi(\bar{e}) - pP + \psi(\underline{e}^*) + (\underline{\beta} - \underline{e}^*) + K - R \\ \text{with probability } (1 - \nu) & : \tilde{G} = \psi(\bar{e}) + (\bar{\beta} - \bar{e}) + K - R \end{aligned}$$

The presence of the regional government has an effect also on the probability of sending an ex-post auditor, the optimal probability is:

$$p = \frac{\nu}{1 - \nu} \frac{P}{2H} (1 - \xi + \xi k) \quad (38)$$

which is decreasing in ξ the precision of the signal received by the regional government.

It is now evident how the European Commission may benefit from ex-ante and ex-post evaluators when making grant decisions. The presence of an ex-post evaluator and the potential punishment contribute to the reduction of the informational rent that must be given to the firm to ensure truth-telling, this has a direct effect on the grant which is equally reduced.

An indirect effect comes from the fact that the stake of collusion between the firm and the regional government is reduced. In other words the amount of resources that the firm may lose if the regional government reports everything it has learned is now lower, as a consequence the sum available to contribute private benefits to the regional government is also reduced. This makes fighting collusion a bit cheaper for the Commission.

The presence of the regional government acting as an ex-ante evaluator also brings benefits and savings to the Commission. The reason is that, in the event of a meaningful signal received by the regional government, it is cheaper to obtain truthful revelation from the regional government than from the firm itself. This is due to the inefficiency of collusion which gives the Commission an advantage over the firm when transferring funds to the regional government and to the copayment of the grant which realigns, at least in part, the incentives of the regional government and those of

the Commission.

3.4 Some comparative statics.

The EU structural funds are destined to the financing of projects in all of the member states which are likely to differ under many and important aspects. Some of the parameters of the model can be used to take into account some possible differences and to evaluate how the optimal decision by the Commission will vary.

- 1. The copayment share α .** The percentage of the project which is to be financed by the regional government is not fixed. It will vary from project to project and everything equal it is likely to be higher in richer member states (typically the "old" members). As α increases the interests of the regional government will be more in line with those of the Commission implying that it is easier for the latter to fight collusion at the evaluation stage. To the contrary the regional governments of the new member states must be given a more generous compensation to carry out the evaluation task. Adding to the higher share financed by the Commission this makes the financing of projects in the new member states relatively more expensive than in the old member states.
- 2. The efficiency of collusion k .** Diverting funds into the hands of local politicians can be more easily done in some states than in others. In some countries where the regional governments are used to obtain private benefits from the political activity it will be easier for the firm to convince the regional government to conceal some evidence about its efficiency parameters. This means we will face a higher k that will take various forms: the presence of many channels in which funds can flow from firms to politicians and administrators, higher tolerance from the public, less efficiency of the regional police in fighting corruption or an easier way to transform the given goods and services into money. Those countries with a lower k , those that are less prone to collusion, will be a more fertile ground for the Commission grant. Lower sums will achieve better projects.⁴
- 3. The cost of ex-post evaluation H .** Accounting procedures and certification standards vary across member states. It is therefore reasonable to assume that the cost of ex-post evaluation will be lower in those states where the information

⁴In principle empirical testing or simulations can be done by proxying k with a governance index, such as the one proposed by Kaufman, Kray and Mastruzzi [2005].

for financial and economic analysis of projects are more complete and credible. Clearly the probability of an ex-post evaluation increases as the cost of the audit decreases, contributing therefore to the reduction of the grant necessary to finance the project carried out by an efficient firm.

4 Conclusions.

Standard incentive theory provides a basis for understanding how different players interact in an investment planning game. It assumes that each player acts to maximize his or her particular objectives. Having two governments, one supra-national and benevolent and the other one with a private agenda, adds complexity to the principal-agent framework, but can be helpful in the study of the relationship between supra-national players who offer matching grants and their beneficiaries.

In the real world actual planning games are often complex. Players can be far more than two, they can be at very different hierarchical levels and, in some circumstances, one player could be both a principal and an agent at the same time. In addition, contractual arrangements to regulate their interactions, as well as schemes to delegate responsibilities, can be of very different nature. Relations among actors can be horizontal or vertical and each typology can be observed at the same time in the same scheme. This planning complexity is particularly important in the case of regional development policy, which is characterized by a multi-government setting with many actors.

Having said this, our model contributes to the application of incentive theory in a multi-government setting by focusing on a co-financing decision in the context of regional policies. Our model shows that ex-ante and ex-post evaluation can critically contribute to contain socially costly rents. To do so, however, the contract between the EC (or any supra-national benevolent development agency) should establish a formal mechanism of rewards and punishment. The regional government, who is responsible for ex-ante evaluation, should be paid to disclose information on the firm and to avoid collusion. There should be a punishment following ex-post evaluation when the firm has been discovered to be more efficient than it claimed ex-ante.

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