Co-financing of infrastructure and regional governments’ incentives

M. Pilar Socorro
Abstract

Large infrastructure projects usually require co-financing by the central government. In a context of asymmetric information, the way in which projects are financed might encourage regional governments to have an optimistic bias when presenting projects that are competing for national funds. On the one hand, in this document it is shown that if the central government funds a percentage of the project costs, the result is that some projects that should not be financed are finally funded, and some other socially desirable projects are not funded or inadequately financed. On the other hand, the document presents some possible solutions to this problem of asymmetric information.
Table of contents

1. INTRODUCTION .................................................................................................................. 3
2. THEORETICAL MODEL OF REFERENCE ......................................................................... 4
3. THE SPANISH CASE ............................................................................................................ 9
4. CONCLUSIONS .................................................................................................................... 12
REFERENCES .......................................................................................................................... 15
1. INTRODUCTION

Large infrastructure projects involve large investments of money that regional authorities can only carry out through co-financing from the central government. To receive funding, regional governments must submit a project to the central government, which will decide on the appropriateness or not of the project and the need to co-finance.

The way projects are funded may encourage regional authorities to have an optimistic bias when presenting projects that are competing for national funds. In fact, there is empirical evidence that when submitting an infrastructure investment project, local authorities tend to underestimate the costs, time and risks of executing the work involved, and to overstate the benefits of the project. For example, it is estimated that the underestimation of costs in the construction of transport infrastructure is around 44.7% for railways, 33.8% for bridges and tunnels and 20.4% for roads. The overestimation in passenger demand is also consistent, hovering around 51.4% in rail projects (Flyvbjerg, 2008).

The central government cannot always detect or correct these optimistic biases. In general, regional governments (the agents in this relationship) have more information than the central government (the principal) on the adequacy and social benefit of undertaking certain investments, so the central government will face an adverse selection problem. If we assume that there is a mismatch between the objectives of the central government and the regional governments, we must examine the consequences in terms of incentives of the co-financing mechanisms from the state. Thus, the central government may be financing projects whose social value is not positive and not financing projects whose social value is positive.

The objectives of regional governments may differ from those pursued by the central administration for multiple reasons. The simplest and least controversial discrepancy is that under the assumption that both administrations pursue social welfare, the territorial dimension in implementing this final goal is not the same. Suppose for simplicity that the central government pursues the general interest and the regional governments those of the region they represent. We will refer to the two areas as global and local.

The simplest reason for discrepancy arises when the social benefits of the project are the same for both administrations, but the costs financed by the central government are not considered as own costs by regional governments. The net profit for the investment project is higher from the local perspective since regional governments underestimate the costs of the project.

There may also be a discrepancy regarding who receives the benefits. The central government may have an interest in a rail line through region A whose social benefits are
distributed 50% each between that region and the surrounding areas. In this case the benefit from the perspective of the regional government in region A is half of the benefit that the central government considers when deciding where to invest.

It is also possible that negative spillovers occur outside region A and thus they are not considered by regional governments, but they must be taken into account by the central government in the process of evaluating the investment. At other times, projects may produce apparent benefits, but in reality are transfers that do not increase the wealth of the nation as a whole. Perhaps from the regional perspective they can be seen as social benefits, but not from a global perspective. This is the case with many of the indirect effects involving deviation of economic activity.

The rest of the paper is organized as follows: Section 2 presents the theoretical model of reference, the problem of asymmetric information and the consequences of the central administration financing a percentage of the total project costs. Section 3 refers to the Spanish case. Finally, in Section 4 we make some policy recommendations.

2. THEORETICAL MODEL OF REFERENCE

The theoretical model that will serve as a reference for understanding the problems of asymmetric information faced by the central government when co-financing transport infrastructure in a particular region is based on the article by De Rus and Socorro (2006).

To analyse the effects that the problem of adverse selection has on the final outcome, let us assume that the central government pursues social welfare from a global perspective and wants to carry out the “good” projects, i.e. those whose net social benefits contribute to increasing the welfare of the nation overall. The central government has insufficient information to distinguish between projects that are “good” or “bad”, and the selection of the projects to be executed is carried out by the regional governments.

If the central government knows a priori the net social benefit of the projects, it would finance those projects that have positive net present value, and therefore satisfy the following condition:1

\[ \sum_{i=1}^{T} \delta^i (BS_i - CS_i) > I. \]  

[1]

1 Assuming there is no budget constraint and we are deciding whether to accept or reject the project. We are not making a ranking of projects within a limited budget.
where \( I \) represents the total investment cost at time zero, \( T \) the lifespan of the project, \( BS_t \) the social benefits in year \( t \), \( CS_t \) the social costs in year \( t \) and \( \delta \) the discount factor.

The interpretation of expression [1] is immediate: in principle a project is socially desirable if the flow of social benefits and costs over the life of this project, duly discounted with the social rate of discount, is higher than the initial investment.

Regional governments would be willing to fund from their budgets the investment projects that meet the following condition:

\[
\sum_{t=1}^{T} \delta^t (BL_t - CL_t) > I_L,
\]

where \( BL_t \) are the local benefits in year \( t \) and \( CL_t \) the local costs in year \( t \). \( I_L \) represents the cost of the investment incurred by regional governments at time zero.

The interpretation of expression [2] is again immediate: a project is in principle locally desirable if the flow of local benefits and costs over the life of this project, duly discounted with the social rate of discount, is higher than the initial investment supported by regional governments. If the central government does not finance anything, the investment cost incurred by regional governments coincides with the total cost of investment: \( I = I_L \). In general, the investment cost incurred by regional governments is a proportion of the total cost. Formally: \( I_L = \beta I \) with \( \beta \in [0,1] \), where \( 1 - \beta \) represents the proportion of investment that is financed by the central government.

In general, regional governments know the specifics of their project and are able to provide a good approximation of the benefits and costs that their projects generate in their region. However, the central government is generally less informed than the specific regional government about each project, so it will be harder for it to predict the costs and benefits that each project has not only for a certain region but also for the entire country. It is therefore reasonable to assume that regional governments know a priori the net local benefits of each project, while the central government is unable to distinguish ex ante the social value of the submitted projects, thus facing an adverse selection problem.

For simplicity we assume that the time period considered, the discount factor and the total cost of the investment are identical for all the projects submitted by regional governments. We also assume that there is a budget constraint and that the central government finances a proportion \( 1 - \beta \) of each investment project submitted by regional governments until the public funds to this line of funding are depleted.
In particular, we assume that there are \( n \) regional governments, each of which may present a project to be co-financed. Each regional government must decide sequentially whether to present a project to be partially funded or not. Let \( n^* \leq n \) be the total number of projects submitted for co-financing by the central government. A priori the central government does not know the social value of the projects submitted to it, so it will fund all the projects allowed by its budget constraint. Let \( \bar{S} \) be the total amount of public funds available for co-financing these projects. All the submitted projects will be partially funded if the following budget constraint is satisfied:

\[
(1 - \beta)n^* I \leq \bar{S}. \tag{3}
\]

If the budget constraint given by (3) is not satisfied, the projects would be co-financed sequentially until the budget is exhausted (remember that the central government faces an adverse selection problem and cannot distinguish a priori the social value of projects).

We assume that regional governments do not have budget constraints, so that whenever a project is profitable from its territorial point of view it could be funded. The reason for introducing this assumption is to simplify the analysis. When interpreting the results we will indicate the consequences of relaxing this assumption.

In this model we can distinguish the following cases.

**CASE 1:** For all projects, the difference between the social benefits and social costs coincide with the difference between the local benefits and local costs for any year \( t \). Formally:

\[
BS_t - CS_t = BL_t - CL_t, \text{ for every } t \tag{4}
\]

**Case 1.1:** All the projects are socially and locally profitable. Formally:

\[
\sum_{i=1}^{T} \delta^i (BS_i - CS_i) = \sum_{i=1}^{T} \delta^i (BL_i - CL_i) > I > \beta I. \tag{5}
\]

In this case, whether co-financed or not, all the projects will be carried out and all of them will be profitable from the social point of view. Therefore, the central government’s financial aid has only redistributive effects, but it does not change the number or selection of projects carried out in the country.

**Case 1.2:** Benefits and costs coincide for the central government and regional governments, but there is a project that is not socially profitable without subsidy. It is locally profitable
upon the regional governments receiving a percentage $1 - \beta$ of the costs of investment. Formally:

$$I > \sum_{i=1}^{T} \delta^i (BS_i - CS_i) = \sum_{i=1}^{T} \delta^i (BL_i - CL_i) > \beta I.$$ \[6\]

Projects that meet condition [6] are “bad” projects for both administrations, but the fixed subsidy rate $1 - \beta$ makes them “good” for regional governments. In this case, projects could be financed that are not profitable from the social point of view. Furthermore, if the budget constraint given by [3] is not met, it could happen that the central government funds a “bad” project but does not finance a “good” project, because the latter is presented when all the public funds to finance such projects are exhausted.

**Case 1.3:** There is a project that is not profitable either socially or locally. Formally:

$$I > \beta I > \sum_{i=1}^{T} \delta^i (BS_i - CS_i) = \sum_{i=1}^{T} \delta^i (BL_i - CL_i).$$ \[7\]

In this case, this project will not be proposed by the corresponding regional government and therefore will not be funded, so that the non-observability of the social value of the project will not have adverse effects on the society.

**CASE 2:** For all the projects, the difference between the social benefits and social costs is lower than the difference between the local benefits and local costs for any year $t$. Formally:

$$BS_i - CS_i < BL_i - CL_i, \text{ for every } t.$$ \[8\]

**Case 2.1:** All the projects are profitable from the social and local standpoint. Formally:

$$\sum_{i=1}^{T} \delta^i (BL_i - CL_i) > \sum_{i=1}^{T} \delta^i (BS_i - CS_i) > I > \beta I.$$ \[9\]

In this case, all the funded projects would be profitable from the social point of view. If the budget constraint [3] is not satisfied only some of them would be funded, although those projects not funded would also be carried out, as they would be profitable for regional governments even without co-funding. Again in this case, the central government’s financing mechanism would only have redistributive effects.

**Case 2.2:** There is a project of a regional government that is not profitable either locally or nationally, but it is attractive from the local perspective when it is subsidized:
This is the worst case because projects whose social costs are lower than their social benefits from a global and local perspective become attractive to regional governments when the central government co-finance the project. The funding mechanism would be producing a selection of “bad” projects associated with losses in efficiency that may increase, if once the budget constraint is binding, the central government rejects other “good” projects that are submitted later.

**Case 2.3:** There is a project that is not profitable either locally or nationally. Formally:

\[ I > \sum_{t=1}^{T} \delta^t (BL_t - CL_t) > \beta I > \sum_{t=1}^{T} \delta^t (BS_t - CS_t). \]  

[10]

In this case, even with public co-funding, the project is unprofitable from the local perspective, so it will not be proposed by the corresponding regional government.

**CASE 3:** For all projects, the difference between the social benefits and social costs is greater than the difference between the local benefits and local costs for any year \( t \). Formally:

\[ BS_t - CS_t > BL_t - CL_t, \text{ for every } t. \]  

[12]

**Case 3.1:** There is a project that is not profitable either locally or nationally.

\[ \sum_{t=1}^{T} \delta^t (BL_t - CL_t) < \sum_{t=1}^{T} \delta^t (BS_t - CS_t) < \beta I. \]  

[13]

Again, although it can obtain co-financing, the project is not profitable from the local perspective, so it will not be proposed by the corresponding regional government. The adverse selection problem is therefore harmless.

**Case 3.2:** A project exists that is locally profitable if it is partially funded, though it is not profitable without public funding. Formally:

\[ \beta I < \sum_{t=1}^{T} \delta^t (BL_t - CL_t) < \sum_{t=1}^{T} \delta^t (BS_t - CS_t) < I. \]  

[14]

In this case, the regional government will propose a project that is not profitable from the social point of view. Due to the budget constraint, it may happen that “bad” projects are financed while some “good” projects cannot be funded.
Case 3.3: There are some projects that are socially profitable from a global perspective but they are not attractive from a local perspective.

\[
\sum_{i=1}^{T} \delta^i (BL_i - CL_i) < \beta I < \sum_{i=1}^{T} \delta^i (BS_i - CS_i). \tag{15}
\]

In this case the central government wants the projects that meet [15] to be carried out, but for regional governments these projects are not attractive because the investment costs are higher than the net social benefit flow from their local perspective. There is a reason, therefore, to subsidize the implementation of such projects. In particular, the amount that should be subsidized is obtained by subtracting the national net social benefit from the local. Thereby, we obtain the optimal proportion \(1 - \beta^*\) that should be subsidized:

\[
\sum_{i=1}^{T} \delta^i (BS_i - CS_i) - \sum_{i=1}^{T} \delta^i (BL_i - CL_i) = (1 - \beta^*) I. \tag{16}
\]

In general, the central government sets a unique value \(1 - \beta\) for all investment projects, so there are two possibilities for projects that satisfy condition [15]:

- \(1 - \beta^* \leq 1 - \beta\) and therefore all projects that are desirable from a global perspective are carried out because regional governments internalize the benefits not perceived as their own. Usually this is achieved through a subsidy higher than strictly necessary, incorporating some of the funds as a transfer with purely redistributive effects.

- In cases where condition [15] is satisfied but \(1 - \beta^*\) is greater than \(1 - \beta\), the financing of the central government will not be sufficient to carry out projects that are socially desirable from a national perspective, but that are not profitable from a local perspective despite the subsidy. This means that some “good” projects are not proposed because the subsidy is smaller than the optimal.

3. THE SPANISH CASE

The co-financing of infrastructure in Spain is a very common practice. For example, the funding strategies of the planned activities within the Plan Estratégico de Infraestructuras y Transporte (PEIT) clearly state “counting on the participation of the regional and local governments on the funding of concerted actions” (PEIT, 2004).

A clear example of co-financing of transport infrastructure projects is constituted by the so-called Convenios de Financiación de Infraestructuras Ferroviarias. They establish the agreements that regulate the relationships between the central Government and the regional
governments in order to co-fund the investments in railway infrastructure in a given geographical area.

Through the so-called *Convenios de Financiación de Infraestructuras Ferroviarias*, the central Government has been funding a third of the costs of certain actions. While up to 1995 only investments that were considered as “priority” were financed, since 1995 there has been a move towards co-financing a range of investments provided they do not exceed a specified amount and that they are co-funded by regional governments. Nowadays, therefore, a range of investments is financed in which the central Government cannot clearly distinguish which projects are really optimal from the social point of view. In other words, what is happening is that the central Government is facing a problem of *adverse selection*.

**Consequences of the subsidy by the central government of a third part of the investment projects selected by regional governments**

Recall that the analysis is situated in a context of asymmetric information in which the central government cannot distinguish between “good” and “bad” projects. “Good” projects refer to those projects that from a global perspective have a positive net present value. On the contrary, “bad” projects refer to those projects whose net present value is negative from the global perspective, though it can be positive or not from the local point of view.

Regional governments select projects for investment in rail infrastructure and present them to the central government in order for the third part to be subsidized. The central government subsidizes until it reaches the limit of total funds available for this line of action.

The mechanism of the third part for all the submitted projects has mainly the following financial implications:

i. When the flows of social benefits and costs are equal to or lower than the local ones, we can distinguish three situations:

- If all the projects are socially and locally profitable, the subsidy is a mere transfer of income, provided there is no local budget constraint; if there is such a constraint, the funding of the central government could be facilitating the execution of some “good” projects for which there would not be local funding.

- If there is a project that is not globally profitable but it is locally profitable when regional governments receive one-third of the cost of investment, projects could be financed that are not profitable from the social point of view. The efficiency losses resulting from the selection of an undesirable project may be even greater if in the
process of selection, with a binding budget constraint, “good” projects from other regional governments are rejected.

- If there is a project that is not profitable either globally or locally, this project will not be proposed by regional governments and therefore will not be financed. Adverse selection in this case has no negative effect.

ii. For the case where the difference between the social benefits and social costs is greater than the difference between the local benefits and local costs, we can distinguish the following situations:

- If there is a project that is not socially or locally profitable even with a subsidy, it will not be proposed by the relevant regional government and the adverse selection problem will be innocuous.

- With the third-party subsidy a non-profitable project from the social perspective could be co-financed. If there are insufficient funds to finance all the projects, the negative effect could be larger, since it could be left without funding a “good” project in exchange for funding a “bad” project.

- When the social benefits of the project outweigh its costs from a global perspective but not from the local perspective, the introduction of an investment subsidy for the difference in net benefits between the two perspectives allows the “good” project to be financed; however, as the subsidy is established a priori as a fixed proportion of one-third of the investment, too much money may be allocated to “good” projects that do not need it and too little to “good” projects for which one-third is insufficient, which with a binding budget constraint could lead to the rejection of projects that are “good” from a global perspective.

In summary, the adverse selection problem implies that some projects that should not be funded are financed, while there might not be sufficient funds for projects that should be carried out.

We have argued that the reasons why the benefits of projects may differ between the overall perspective of the central government and the local perspective of regional governments are basically externalities of one local community over another. They may be positive, for example, a railway line in community C that allows traffic from A to B, generating superior returns for the nation to those enjoyed by community C. Moreover, a project that represents only a deviation of activity from A to B without additional benefits is a project that may be interesting to B but not to the nation composed of A and B, for which the project would simply produce a transfer of profits and the additional cost of running it.
Some examples of infrastructure investments that may involve significant discrepancies in net profit depending on the area considered are the transfers, some activities in port investments (for example, competing to attract container traffic) and airports that want to be hubs in a territory in which there is no traffic for several hubs. However, in the case of railway investment in metropolitan areas and metros and trams, which are the main types of investment financed by the central Government in Spain, it seems reasonable to assume that the discrepancy is not significant.

If global net benefits are similar to local net benefits, as in the Spanish case, the subsidy of one-third of the investment could merely have redistributive effects in the case of “good” projects. However, it could also encourage the execution of “bad” projects. In any case, the financing of a fixed proportion of any project and several regional governments competing for funds may encourage regional governments to present “bad” projects, a behaviour that resembles the prisoner’s dilemma: although every regional government knows that this system leads to carrying out “bad” projects nationally, individually they are interested in applying for funding, which would otherwise be spent on other regional governments. This produces a process of adverse selection and a pressure on regional governments in subsequent periods, with the intention of raising additional public funds of the central government to this line of action. In short, any regional government is interested in presenting “bad” projects as long as the central funding makes them profitable. This strategic behaviour is general and ends up in a suboptimal solution for all the agents, an irrational situation from a collective perspective, but completely rational if it is considered separately from the local perspective.

4. CONCLUSIONS

In this paper we have analysed a problem of asymmetric information in which the central government is not able to distinguish the social value of the projects proposed by regional governments. Even though regional governments are required to produce a cost–benefit analysis of each submitted project, the way in which projects are financed encourages regional authorities to have an optimistic bias when presenting projects competing for national funds. Given the problem of asymmetric information, the central government cannot always detect or correct these biases.

In the previous section we show that if the central government is funding a fixed percentage of the project costs, the result is that it finances projects that should not be funded and it does not fund, or inadequately funds, some socially desirable projects that would not eventually take place.
One possible solution is for the central government to make its own cost-benefit analysis of all the projects submitted for funding and to compare it with the cost-benefit analysis presented by the regional governments. While this can be an expensive alternative, it would enable the central government to know in advance the true social benefit of the project to be financed. For this last policy to be effective, it should be accompanied by a penalty for those regional governments that submit projects offering optimistic biases (the penalty would not necessarily be monetary; it could simply be a bad reputation for future negotiations). However, the imposition of a penalty could be considered an unfair measure since regional governments may not be fully informed of the true social value of their projects.

Another possible solution would be to determine, on the basis of national and international experience, certain parameters to adjust the estimated costs and benefits of projects. These parameters will improve the accuracy of ex ante evaluations of transport projects and will minimize the “optimistic bias”. This is the idea behind the method called “reference class forecasting” based on the theories of the winner of the Nobel Prize in Economics Daniel Kahneman (Kahneman and Tversky, 1979a, 1979b; Kahneman, 1994). The application of this method to a given investment project requires:

1. The identification of a suitable reference group, taking into account what has happened in the past with similar projects. This reference group should be broad enough to have statistical significance but small enough to be truly comparable with the project under analysis.

2. The establishment of a probability distribution for the reference group. This requires access to a reliable database for a large enough number of projects within the reference group in order to reach conclusions with statistical content.

3. A comparison of the analysed project with the probability distribution of the reference group, so that we can extract the most likely outcome of the project discussed.

Therefore, with the “reference class forecasting” method, we do not aim to remove the uncertainty associated with the projects, but to locate a specific project within a probability distribution for the results of other projects in the reference group (Flyvbjerg, 2008). In this way, we would minimize the so-called “optimistic bias”.

A suboptimal but much simpler policy would consist of making a fixed transfer to regional governments. With that money and the money from their own budgets, regional governments would be able to assume the cost of the project or projects they decide to undertake. Thus, each regional government would allocate public funds to those actions and places within its territory that it deems appropriate. In this manner we would leave the
prisoner’s dilemma discussed in the previous section, in which all regional governments propose “bad” projects because that is what the rest of the regional governments do.

A fixed transfer to regional governments seems to be the easiest policy to implement and the most efficient one, with the additional virtue of being politically attractive due to the delegation of responsibility it involves. Moreover, this policy is not incompatible with the requirement to regional governments to submit a cost–benefit analysis to the central government, where they explain the purpose of the project, justify that the project is the best way to achieve this objective and identify and quantify the flows of benefits and costs of the project. This additional measure, without being costly, could be useful for regional governments themselves in selecting their own projects, and it could contribute to improving the practice of economic evaluation of projects in a country.

The first advantage of this system is the elimination of the strategic behaviour of regional governments asking for national funding. Now, regional governments will only be interested in funding the best projects within their region, as the funds are predetermined and it is in their own interest to gain the most out of them.

The second advantage is that if the central government fixes the quantities ex ante, for example for periods of five years, regional governments can plan their investments some time before instead of responding to political negotiations fraught with strategic behaviour, as happens nowadays.

The third advantage is political. With the alternative lump sum mechanism, it is the regional governments that decide how to allocate the funds without the supervision of the central government. If the regional governments have more information about the characteristics and needs in their region, they are also the ones who know better how to make the central public financing profitable.
REFERENCES


