An Evaluation of EU regional policy. Do Structural Actions crowd out Public Spending?

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Abstract

One third of the European Union budget is devoted to Structural Actions, with the aim of enhancing economic growth in less developed areas. Thirty years after the creation of the Europan Regional Development Fund (ERDF) there is no consensus in the evaluation of its effectiveness. In this paper we test whether EU Structural Funds crowd out public investment in the member states. Using annual data from fifteen member countries, from 1993 to 2005, we conclude that there is no total crowding-out and that public investment in the member countries makes up around 60% of the increase in EU funds. In a posterior analysis with data from the Spanish regions the results reveal that the implementation of the Cohesion Policy might identically encourage investment at other levels of public administration. We interpret the results with the help of an extended version of the AK model that discriminates the effect of matching and lump-sum grants to public investment.

Keywords: Structural Funds, Regional Policy, Public Investment, Panel Data.

JELClassification: C23, E62,H5,O52, O38.

Acknowledgement 1 *The author is extremely grateful to Anindya Banerjee for excelent supervision and helpful comments. The usual disclaimer applies.*

1 Introduction.

In the early seventies much was written about the effects of intergovernmental grants on public expenditure. Transfers between different governments -usually from upper to lower levels of the public administration- became an oft-used tool often with the purpose of enhancing public expenditure in determined areas (education, infrastructure, etc.). These subsidies are usually given the condition that they are invested in certain targeted policies or programs. However, as

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long as the subsidized government is free to administer the rest of its budget, these transfers could simply crowd out the resources previously allocated in the subsidized areas to other alternative uses or to reduce tax revenues.

In fact, in a neoclassical model of local government, with fully informed agents and perfect political competition, alterations to private income are perfectly substitutable by equivalent alterations to public revenue. The result of giving a lump-sum grant to households or giving it to public bodies would be identical. Governments receiving grants would increase their public expenditure only because of a wealth effect, which would be identical to distributing the grants homogeneously through the population. However, many empirical studies[1] have revealed that the grants provided by the US federal government have boosted state and local public expenditure. Economic theory has responded to this through two main strands of research.

A first line of research analyzed the necessary conditions that make lump-sum public grants boost public spending more than an equivalent increase in private income, i.e. the "flypaper effect". The most standard explanations refer to the rigidities in the decision-making process (Dougan and Kenyon (1988)). Pressure groups that perceive higher utility from public spending than the average voter take advantage of the "fiscal illusion " induced by a lump-sum subsidy. But alternative ways to explain the phenomenon have also emerged. According to Hamilton (1983) and King (1984), the variations of the public expenditure decisions could come as a response to changes in local socioeconomic characteristics induced by the grants.

The second strand of the literature has been largely inspired by the work of Bradford and Oates (1971), and tries to identify under which conditions public grants are more effective in boosting public expenditure. In particular, this literature evaluates the use of matching-grants, which provide a funding for a particular public good proportional to the level of expenditure of the subsidized government in that public good. More recently, Chubb (1985) and Melo (2002) have tried to model how in less popular policy areas lump-sum grants do lead to local spending cuts that push the level of public expenditure down to its original level. This makes the use of matching grants more advisable if the purpose is to push up expenditure. As in opposite to more popular policies areas: policy-makers would always find incentives to enlarge public spending in those, making lump-sum grants also a valid tool to reach the desired increase in spending.

We evaluate the effectiveness in enhancing public investment of the grants system established under the European Structural Actions. The European

[1] Weicher (1972) and Feldstein (1975) among others. Fisher (1982) includes a complete literature review.

Union began its Cohesion policy in 1975 devoted to reducing the existing differences among the various regions and promoting economic growth, especially in less favoured areas. It implemented a system of matching grants through the Structural and Cohesion Funds, which were conceived to push up public investments and expenditures in key areas for enhancing growth. The channel through which the Funds try to push public investment up in those areas is by making an EU contribution to certain projects conditional on a certain level of expenditure of the member countries on those projects. The aim of this "matching" system is to prevent that the share of public expenditure that would otherwise be devoted to certain kinds of public investment from being deviated to a different category of public expenditure after the implementation of the grant.

Using panel data from 15 European countries for the period 1993-2005 we test the extent to which these grants enhance public investment effectively. We use standard fixed-effects and random-effects estimation in a linear model with autocorrelated errors and the GMM Arellano and Bond (1991) estimator in a dynamic modification of the model that takes into account the endogeneity of the explanatory variables. We repeat a similar analysis with data from the Spanish regions (NUTS 2) to control whether the previously estimated effect is homogeneous among levels of the public administration.

We estimate that only 60 percent of the increase in the Structural Funds received by the subsidized government are used to increase public investment. The remaining 40 percent of the transfer is crowded out towards other alternative uses, like public consumption.

Using an extended version of the AK model, we examine the link between matching grants and public investment under neoclassical technology and an exogenously determined tax rate. The model shows how the effect of the matching grant depends on the relative amount used of the subsidized capital, and compares the effect on public investment of a matching grant policy with that from an equivalent lump-sum transfer.

According to our theoretical model, the pattern estimated in our panel can be interpreted as a relatively poor performance of the matching process of the grants established by the European Union. Taking into account the decision process that drives the allocation of the Structural Funds, subsidized governments may take as given an important share of the grants that they perceive, and their behavior towards those would be more likely to consider them as lump-sum transfers rather than lump-sum grants. This may happen because the European Commission is not totally autonomous negotiating the investment projects in which to invest the Funds. In stead, it must stick to the predetermined amount of Funds agreed in the European Council.

Section 2 introduces a theoretical framework about matching grants, section 3 summarizes the econometric techniques and modelling used in previous related studies, section 4 describes the European cohesion policy, section 5 introduces the variables and data used, section 6 explains the model and interprets the results and section 7 concludes.

2 Theory on the effectiveness of public grants in boosting expenditure. A neoclassical framework.

Bradford and Oates (1971) is the response to previous efforts to find a common theory on intergovernmental grants. They prove that under simple majority rule with fixed tax shares and a single public good, a matching grant will always lead to a larger public expenditure than a lump-sum grant of the same amount. The key assumptions are the presence of an individual decision-maker with preference patterns of the usual sort and a collective decision made by simple majority rule. Gramlich and Galper (1973) develop the analysis further by including in a model three different types of grants[2], and a local government with a very complete utility function that includes, among other factors, the level of current public expenditures. They conclude that matching grants have a larger effect on public expenditure, while the impact of closed-end lump sum transfers on public expenditure remains quite low.

Most subsequent work on intergovernmental grants has focused on exploring theoretical explanations to explain why lump-sum grants to public bodies boost public expenditure more than an equivalent increase in public wealth (flypaper effect). These explanations concentrate on complexities in the public policy process, agenda setting, fiscal illusion, etc. A good example is the setter model proposed by Romer and Rosenthal (1980), in which an agent whose target is to maximize public expenditure takes part in the process of determining the public budget. Hamilton's (1986) explanation relies on the deadweight loss of welfare created by increases in taxation. Borge (1995) develops the fiscal illusion model of Wallace Oates and shows that it unambiguously predicts a flypaper effect.[3]

However, for many years the conditions under which public grants boost a larger share of public expenditure have been relatively unexplored. Chubb (1985) expands the interpretation in Bradford and Oates (1971) by arguing

[2] open-end matching grants, closed-end lump-sum transfers and closed-end categorical grants, that transfers a limited amount of money to be used for a specific program.

[3] Bailey and Connolly (1998) include a complete summary of theoretical explanations and critics of the flypaper effect in which they list 10 existing theoretical reasons that previous analyses have used to model the flypaper effect.

that the implementation of matching or lump-sum grants responds to the solution of a hierarchy principal-agent problem existing between federal and state governments. Other studies, like Bahl and Duncombe (1988), Bahl and Sjoquist (1990), and Deller and Walzer (1995), have focused their attention on the persistence of the policies, by considering budgetary decision-making in a slightly longer-term view. Grants revenue can be viewed as something more or less permanent. If a public body can count on grant revenues for the long term, they will easily substitute their own revenues. Alternatively, if aid is considered transitory, they will be less likely to substitute other revenues and will serve better to their purpose of enlarging the public budget, using these funds for one-time ventures.

Knight (2002) uses a bargaining model, based also on Bradford and Oates (1971, 1971b), in which grants and public expenditure are the result of a two-stage process: the first (federal budgetary stage), in which a federal legislature, with one representative from each state, determines the distribution of grants across states from the federal budget, and a second stage (state budgetary stage) in which state governments, taking first-stage intergovernmental grant levels as given, allocate federal grants and private income between public and private consumption. He shows that the allocation of grants is endogenous to the state's preference to increase its expenditure. This may be the reason why many estimations may upwardly bias the public expenditure response to grants.

One of the more recent and outstanding contributions to the theory of intergovernmental grants is the paper by Volden (2007). His model includes a game, solved through subgame perfect equilibrium and backward induction, in which elected politicians in a national and subnational governments compete with each other to claim credit for providing goods and services in a given policy area. The politicians are seeking to represent the desires of their constituency.

His more interesting findings regarding the response of public expenditure to federal grants are, firstly the dependence of the effect on the capacity of the recipient government to efficiently raise taxes, so that governments with greatest tax efficiency would experience higher crowding-out induced by the grant. Secondly, the donor government would increase its grant size under some conditions (namely demand for the good) that also affect the propensity to spend of the subnational government. This would give the appearance of a smaller crowding-out effect, since the increase in the good provision would have occurred without the grant. Identically, a decline in the tax efficiency could provoke an opposite reaction under which more of a crowding-out effect would be detected.

2.1 Matching grants in a simple model of neoclassical growth.

We will use a version of the simplest neoclassical model of substained growth to see the transition mechanism that drives the impact of matching grants to public investment onto public expenditure . We have modified the so-called AK model, where the production technology is linear in capital, to include two types of public capital in the production function. Since our interest yields exclusively in the behavior of public expenditure, we assume an exogenously determined fixed tax rate.

Two types of public capital have been included to make the model more intuitive. Our purpose is to replicate the effects of the implementation of a matching grants system, similar to the one established in the European Union through the Structural and Cohesion Funds. The main target of these policies is to increase economic growth by enhancing public investment. The choice of matching-grants instead of lump-sum grants has precisely the purpose of making public investment more attractive in comparison to public consumption.

We consider a country with an infinitely lived representative median voter, whose preferences depend on the amounts consumed of a private good and a publicly provided public good. The decisions are taken separately, and the household cannot forecast the behavior of the government while taking their own decisions. The households are also the owners of the technology of the country, which produces according to a constant returns to scale production function in which, in addition to private capital, there are two kinds of public capital:

$$Y_t = AK_t^{\gamma} G1_t^{\alpha 1} G2_t^{\alpha 2} \tag{1}$$

We want to see the role that the output elasticities of the public factors have on the response to matching grants. This is why we consider two types of public capital, one of which has a larger output elasticity ($\alpha 1 > \alpha 2$). The model is developed in the Appendix.

The subsidizer, in our case the European Union's structural policy, gives a matching grant to selected types of public capital. The implementation of a matching grant would be translated into the model as a decrease in the relative price of any of these two types of public capital, represented either by the parameter δ_1 or δ_2 respectively (δ_1,$\delta_2 \in (0.1)$). The subsidizer would then share the cost of part of the purchase of public capital $(1-\delta_1)G_1$or $(1-\delta_2)G_2$, while the remaining $\delta_1 G_1$or $\delta_2 G_2$ is still paid by the subsidized government through its tax revenues.

With our data we cannot discriminate subsidized from non-subsidized public investment. Therefore, in section 3.6 we estimate the response of total public

investment to the introduction of a grants system in the economy is given by the variation on total public investment after and before the implementation of the grant, that is, the increment $\Delta(G1_{t+1} + G2_{t+1})$. If there is an increase on public investment higher than the grant actually perceived we say that there is crowding-in of public investment induced by the matching grant, while when the increase on public investment is smaller than the grant we define it as crowding-out. The case in which there is zero or negative increment of public investment is called total crowding-out.

In the Appendix we are able to develop the consequences of the introduction of a matching-grant in our particular framework, summarized in the following proposition:

Proposition 2 *In our model neoclassical technology, a matching-grant to one of the types of public capital will always induce a crowding-in effect onto public investment, regardless of the relationship of the output elasticity of the granted capital with that of the remaining production factors, and of the share, of capital granted,* $\boldsymbol{\delta}$*.That means that there will be a positive increase in final public investment higher than the amount granted as a reaction to the transfer.*

This result would imply that if the Structural Funds behave really as matching grant, the coefficient estimated in section 5 should be larger than one. We could admit the possibility that the Funds are not really matching grants since, as we describe later in section 4, their amounts are negotiated in the European Council every seven years and the subsidized States could take as given that they will perceive then. But before introducing this possibility in our model we would like to explore the importance of the elasticity of substitution of the subsidized type of public capital on the crowding-in effect and on economic growth. For that we compare in the appendix the effects of two alternative grants to each type of public capital: in the first case with identical rate of subsidy and in the second with identical cost for the subsidizer, yielding propositions 2 and 3:

Proposition 3 *The response of a public authority towards a matching grants policy on certain kind public investment run by an external institution depends on the relative amount of this kind of public investment used previously. The higher the output elasticity of this kind of public investment with respect to the other production factors, the higher the increase in public expenditure induced by the grant.*

Proposition 4 *The cost to the subsidizer of running a matching grant policy with the purpose of reaching a predetermined increase of public investment does not depend on the output elasticity of the subsidized type of public investment. However, the higher this elasticity of the public investment, the higher the increase in economic growth induced by the reallocation of factors.*

Propositions 2 and 3 summarize the importance of the output elasticity (which indicates also the relative amount of the factors used in equilibrium) on the response of public investment to the matching grants. Proposition 2 explains that the response of a certain type of capital to a matching grant program will depend on its output elasticity (α). Therefore, the comparison of the reaction of public investment to different matching-grant programmes may serve the policy-maker to infer the properties of the subsidized capital: the higher the response, the higher the α associated with this type of capital.

Proposition 2 is useful for the policy maker to identify the type of capital with a higher output elasticity, α ; according to proposition 3, however, the impact of a matching-grants policy on economic growth does not depend only on the amount of money invested, but also on the elasticity of the subsidized capital. Therefore, to make grants more efficient they should be allocated to the type of capital with a higher coefficient α, which is also the more commonly used in equilibrium.

These two propositions can be used for an optimistic interpretation regarding the capacity that the policy maker may have to focus the target of the matching grants policy on the types of public investment that will imply a larger effect on growth. As long as the policy maker must be able to observe the dynamics described in proposition 2 regarding the response of the subsidized capital to the grant -in particular they know the coefficient δ-, that, combined with our estimation here, would serve him to obtain conclusions about the size of the crowding-out effect of the matching-grant policy[4] on non-subsidized capital.

However, regarding the estimation made on this paper, we should expect the estimated coefficient $\beta_1$in equation 2 to be independent of the final effect on economic growth. According to proposition 3 the cost of running a matching grant policy, i.e. the relationship between the subsidized amount and the response of public investment, does not depend on the output elasticity of the subsidized capital. Since in principle we are not able to observe the final effect on output growth, we cannot assess whether the subsidized capital has been optimally targeted or not.

[4] We regress $\Delta \frac{g_{subsidized}+g_{nonsub}}{Y}$ on $(1-\delta)\frac{g_{subsidized}}{Y}$. For the policy maker it must be relatively easy to observe the impact of $(1-\delta)g_{subsidized}$ on $\Delta g_{subsidized}$, and, therefore, obtain conclusions about the crowding-out effect of $(1-\delta)g_{subsidized}$ on Δg_{nonsub}.

Finally, we introduce in our model the possibility for the grants perceived through the Structural Funds to behave as lump-sum grants rather than matching-grants. The joint analysis of our estimations and the decision process described in section 4 may induce us to be skeptical about whether the Structural Funds do actually work as matching grants or as lump-sum transfers. Although they are designed as matching grants, the broad numbers are the result of a bargaining process in the European Council. This means that subsidized governments may take as given that they will receive at least a share of the Funds agreed in the Council. Later on, it will be the work of the European Commission to negotiate with these governments the particular projects and conditions under which the Funds will be invested.

Therefore, we want to check in our model how lump-sum transfers of capital do affect public expenditure. This is done in case C in the appendix, whose conclusions are reported in proposition 4:

Proposition 5 *In our economy with neoclassical technology and a fixed tax-rate, a lump-sum transfer to the government from an external agent will induce a deviation of public resources from public investment towards public consumption such that the government will increase public consumption by a quantity higher than the transfer received. Therefore, there will be a negative increase in final public investment as a reaction to the transfer.*

According to this proposition, lump-sum transfers will induce a very strong crowding-out effect on public investment. In fact, proposition 3 states that the estimated coefficient β_1 in equation 2 associated with a lump-sum grant should be negative[5] since the crowding-out effect would be larger than the grant transferred.

We expect the impact of the matching grants designed for the Structural Funds on public investment to depend on the leeway of the European Commission to effectively decide on the final amount of grants allocated according to the subsidized government's behavior. As long as governments take as given an important part of the transfers, they will treat them as lump-sum transfers and these transfers will crowd out public investment. But if the European commission also has some margin to decide particular investment projects to be developed and the granted amount of money could fluctuate according to the State's investment on these projects, the Funds will work as matching grants and they will crowd in public investment.

Our real scenario could lie somewhere in between a system of lump-sum transfers and matching grants. So, if we assume that a share σ of the increase

[5] while it is only necessary a coefficient smaller than one for the existence of crowding-out

on the Structural Funds is considered as lump-sum transfers by the subsidized governments while the rest of it, $(1-\sigma)$, is transferred according to a matching grant system, from equations 12 and 19 we get the final effect on public expenditure:

$$\frac{\Delta(G_{sub}+G_{nonsub})}{\Delta SF}=\beta\tau\left(\frac{[\boldsymbol{\alpha}_{sub}(\frac{1}{\delta^{1-\alpha_{sub}}}-\mathbf{1})+\boldsymbol{\alpha}_{nonsub}(\boldsymbol{\delta}^{\alpha_{sub}}-\mathbf{1})+\frac{(\mathbf{1}-\boldsymbol{\delta})\mathbf{g_{subsidized}}}{\beta\tau}]}{\Pi_0\Delta(1-\delta)G_{subsidized}}+\frac{(\boldsymbol{\alpha}_1+\boldsymbol{\alpha}_2)(\frac{1}{\Pi_{gS}}-\frac{\mathbf{1}}{\Pi_g})}{\Delta L}\right)$$

where $\Delta L=\sigma\Delta SF$ and $\Delta(1-\delta)G_{subsidized}=(1-\sigma)\Delta SF$

The first term inside the brackets represents the crowding-in effect induced by the matching grants, and is always larger than one, while the second term represents the crowding-out effect induced by the lump-sum part of the funds, and is always negative. We have estimated a coefficient 0.6 for β_1, therefore the Structural Funds are not understood as working precisely as matching grants or lump-sum transfers, but rather as a combination of both depending on the extend to which subsidized governments treat them as unconditionally given.

Finally we will briefly discuss how some of the implications of this model match the results estimated in section 6. Firstly, the level of public investment, $\frac{G_{1,t}+G_{2,t}}{Y_t}$, depends positively on the exogenous tax rate. We do not include tax rate among our explanatory variables, but public consumption as an approximation of public expenditure. We estimate a positive coefficient associated with this variable which is perfectly consistent with this theoretical model. Secondly, private capital in our model is endogenously determined, but if any exogenous shock alters private capital, according to equations 9 and 10 in the appendix, the relative amounts of public investment would also decrease, which is also consistent with the negative coefficient estimated in section 3.6. Finally, our model predicts a negative reaction of public investment towards exogenous changes in economic growth (due, for example, to a change in the technology represented by A) which this time does not coincide with our estimations since we are able to identify an insignificant coefficient attached to growth.

3 Modelling the Effect of Grants on Public Expenditure.

The earlier literature about the effects of grants policies on local and state expenditure emerged in the early seventies, most of them using data from the several

federal grant programs implemented in the US to boost economic growth in less developed States and areas. During this decade, a great number of studies, probably encouraged by the findings presented by Bradford and Oates (1971), examined the extent to which additional grants receipts were associated with greater government expenditure. These studies generally relied on taking cross-sectional variations in grants to be exogenous to the level of public expenditure which they affect. We recall here the study by Gramlich and Galper (1973) in which they estimated an effect of a 25 percentage point response on public local expenditure to alterations in state and federal aid to ten urban governments. More detailed literature reviews on this period may be found in Hines and Thaler (1995) and Bailey and Connolly (1998).

Winer (1983) considered a dynamic specification of the model, but these results did not differ from its static counterpart, and he concluded that public expenditure in Canadian provinces experience an increase slightly higher than the increase in grants perceived, therefore rejecting the crowding-out hypothesis.

Case, Rosen and Hines (1993) estimated the flypaper effect of federal grants on US states in a study in which the main target was to analyze fiscal policy interdependence among states. They setup their model as a standard "fixed effects" linear panel data model in which they introduced common random shocks among neighbors. They also included among the explanatory variables decisions about public expenditure taken by the neighbor states.

They estimated the effect of federal grants on state spending between 0.014 (for "State Administration") and 0.278 (for "Health and human services " expenditure). However, their estimated effect was much closer to 1 in the models that included total public expenditure. These results should be treated with scepticism. Firstly because the results are obtained using very heterogeneous definitions of the weighting matrix used to define "neighborhood ". Apart from physical distance they also consider per capita income and the proportion of the population that is black. Secondly, the results regarding our variable of interest, federal grants, are too volatile. One possibility might be that the absence of some relevant variables provoke both the high level of fiscal interdependence among states as well as the high variance of the results regarding the effects of public grants.

The accuracy of the Case et al. (1993) estimations was soon questioned. Becker (1996) used two main arguments. The first regarded the feasibility of estimating a linear model, while proposing a logarithmic form. The second issue concerned the assumption of the exogeneity of grants received by states with respect to the dependent variable, local and state public expenditure.

She estimated a residual response of public expenditure in the US states to external aid of around 2.2 percentage points. The estimation only includes

lags of the dependent variable, income per capita and tax prices as explanatory variables. This leaves open the possibility that her results may have been influenced by the omission of other factors usually included in related studies, especially demographic variables. The paper by Bailey and Connolly (1998) included an interesting extension of those critiques applied to previous literature, putting emphasis on the use of inappropriate variables and on the use of an inappropriate functional form as the main types of errors identified in previous studies.

Besley and Case (2000) explore the use of different methods for estimating policy incidence when there is a concern about policy endogeneity. Based on their results, most of the previous related regressions might be biased since grants allocation may be considered an endogenous variable in a legislative bargaining model, correlated to preferences for public goods. The Literature on grant policies would need to take into account the possibility of the presence of endogenous variables, in particular the possibility that the distribution of grants and the public expenditure policies are somehow driven by a common preferences pattern. Besley and Case (2000) proposed the use of IV estimation as an alternative to control for endogeneity. They illustrate their conclusions with an example of State policy on workers ' compensation benefits in which the women's political involvement works as a valid instrument of the public policy.

Knight (2002) studied the response of state expenditure on public highways to grants provided by the Federal aid highway program. His interpretation is that the target of this Federal grants program is to enlarge public expenditure in a determinate area by the same amount as the grant received or even more.[6] He takes endogeneity into account by using instruments based on the political power of state congressional delegations, which are correlated to the actual distribution of grants. He finds that federal grants do significantly crowd out state expenditure on highways.

Gordon (2004) estimates the effect induced by US federal grants to elementary and secondary education. She uses IV[7], since she finds that the amount of these grants (called Title I) are computed partially based on former public expenditure on education per pupil. She uses as instruments the set of remaining variables actually used to allocate grants and estimates one to three year first differenced data from 7047 school districts. Her results are very interesting, since she finds a one-to-one short-term effect of federal grants on instructional expenditure, but in the long term the districts "accommodate " their budgets to the grants that crowd out public expenditure and produce a decreasing effect on local revenues (probably because of decreasing taxes).

[6] According to this interpretation, when the flypaper effect covers less than the grant received we can consider that there is a "crowding-out " effect from the grant on this category of public expenditure. Identically, a flypaper effect higher that the grant would mean that the grant perceived "crowds-in " public expenditure on this policy area.

[7] However, her results using OLS do not arrow significant differences.

Author	Sample	MPC from grants	model/est. method	Dep. variable	Other covariates
Gramlich, Galper, Goldfeld and McGuire (1973)	Federal and state aid to 10 local governments, 1962-1970	0.25	Linear/ pooled OLS	General (urban) gov. exp. per capita	grants price effect, robbery rate, suburban taxes
Winer (1983)	Federal grants to Canadian provinces, 1952-1969	1.20	dynamic/2SLS	total actual provinces expenditure	population
Olmsted, Denzau and Roberts (1993)	Public grants to 344 school districts in 1980, Missouri, US.	0.58 - 1.10	tobit/ML	school expenditure in Missouri districts	tax price, students in private schools, number students, urban population, poor pop., black pop., homeowners
Case, Hines and Rosen (1993)	Federal grants to 49 US States, 1970-1985.	0.65 - 1	spatial/ML	state expenditure per capita	population density, pop. over 65, pop. under 17, black pop.
Becker (1996)	Federal grants to local governments, 1977-1986.	0.61	logarithmic/ ML	Per capita pub. exp. by state and all local governments within each state	tax price, income per capita, laged dependent
Gramkhar and Oates (1996)	Federal grants to state and local governments (times series data), 1953-1991	0.62	Linear/2SLS	Total state and local exp. in the US (times series)	unemployment, school aged pop., urban population
Knight (2002)	Federal Highway Aid Program grants to 47 US States, 1983-1997	0.13	linear/IV	state expenditure on highways per capita	Income, population, drivers per capita, vehicles per capita, political representatives
Gordon 2004	Title I grants to over 7000 US school districts	0.98	linear/IV	school district expenditure / revenues per capita	none

Figure 1: Table 1: Selected literature review.

Probably because of the different political settings, there has been little work with European data. A notable exception is the work by Pallesen (2006), in which the author estimates the effect of a change from matching grants to unconditional lump-sum grants from the central government to Danish local government. He shows how for almost all the policy areas the use of lump-sum grants does not seriously alter the pattern of public spending.

4 The European Cohesion Policy.

In this section we describe the system of grants introduced in the European Union through the Cohesion Policy. This Cohesion Policy involves the develop-

ment of certain projects determined by the European Council and the European Commission called Structural Actions, which are partially financed by the Structural Funds and the Cohesion Fund. There are four Structural Funds: the European Regional Development Fund (ERDF), which is intended to finance large infrastructure projects and has the largest weight in the budget; the European Social Fund (ESF), which is the main financial instrument allowing the Union to realize the strategic objectives of its employment policy; the European Agricultural Guidance and Guarantee Fund (EAGGF - Guidance Section), which contributes to the structural reform of the agriculture sector; and the Financial Instrument for Fisheries Guidance (FIFG), which is the specific Fund for the structural reform of the fisheries sector.

These Structural Funds, in particular the ERDF, and the Cohesion Fund (CF), are the main target of our study, since they are intended to promote public investment, not only by the EU, but also by the member countries that receive them, through a system of matching grants that we introduce later.

4.1 Evolution of Structural Actions.

Since the signing of the Treaty of Rome in 1957, the European Union has declared the harmonious development of the economies of the member states as one of its main objectives, by reducing the differences existing among the various regions and the backwardness of the least favoured regions. The initial plan put a lot of emphasis on the development of a common agricultural policy. The creation of the European Regional Development Fund (ERDF) in 1975 represents the beginning of an active cohesion policy. Starting in the European Council in Brussels in 1988, the provision and allocation of the Structural Funds (then referred to as Solidarity Funds) is intended to be overhauled periodically by the Council every five to seven years. The first allocation was negotiated for the period 1989-1993.

Cohesion policy became specially reinforced after the acceptance of the Treaty of the European Union in 1992 that established it as one of the main objectives of the union, and created the Cohesion Fund to support projects in the least prosperous Member States. The distribution of resources accorded in the Edinburgh European Council in 1993, for the period 1994-1999, allocated one third of the Community budget to cohesion policy, almost three times the sum negotiated for the period 1989-93.

The European Council of Berlin in 1999 reformed the Structural Funds for the period 2000-2006 with a budget similar to the period before but with a reorganization of the objective regions into three groups instead of the seven existing before. The main principals regarding objectives, namely procedure,

cofinancing rates and supervision remained almost unchanged. The European Council and the European Parliament have approved the reform of cohesion policy for the period 2007-2013 (European Union. Regional Policy (2006)), with a substantial increase in the budget due to the entrance of the new member states into the EU.

4.2 The European Regional Development Fund in the budget of the EU

In 2005 the Agricultural policy represented approximately half of the total expenditure in the budget of the European Union.[8] The structural actions represented approximately 34% of the budget, allocated among structural funds (31.7%) and cohesion funds[9] (2.3%). More than a half of the Structural Funds corresponded to the ERDF and the rest to the other structural funds.

	ERDF	ESF	EAGGF	FIFG	Total SF
Objective 1	44.88%	16.44%	9.11%	1.30%	71.73%
Objective 2	9.68%	1.10%	0.00%	0.00%	10.79%
Obj. 3 and out.	2.89%	13.16%	0.95%	0.48%	11.51%
Total objectives	57.46%	30.71%	10.06%	1.78%	100.00%
Source: European Commision (2005a), Report on the Structural Funds 2004					

Table 2: Allocation of Structural Funds by Fund and Objective areas.

More than two thirds of the structural actions and ERDF were invested in Objective 1 regions (Objective 1 and 6 in the plan for the period 1994-1999), which are those with a lower per capita income in the EU.[10] The emphasis of the ERDF in those regions is to promote large infrastructure projects, particularly in the context of trans-European networks: transport, telecommunications and energy as well as any other productive activities. In Objective 2 regions (objective 2 and 5b in the plan for 1994-1999) the efforts are focused on diversification

[8] More precisely, the execution of the EU expenditure budget in 2005 allocates 48 465.8 million Euro to Agriculture, 30 526.5 mill. E. to Structural Funds, 2 228.9 mill. E. to Cohesion Fund, 7 520.8 mill E to Internal Policies and the rest to other categories, to reach the total sum of 104 835.2 million Euro. (European Commission (2006))

[9] intended to finance Transport and Environmental projects in member countries with levels of per capita income below 90% of the EU-average.

[10] below 75% of the average of per capita GDP of the European Union.

of economic activities, rehabilitation of industrial sites and infrastructure on a local scale and finally, for the rest of the regions the ERDF acts through the initiatives Interreg III and urban II.[11] (European Commission (2006))

	Objective 1	Objective 2	Obj. 3/other*	Total
Productive Environment	24.78%	6.24%	2.50%	33.52%
Agr. Forestry and Fisheries	*5.80%*	*0.03%*	*0.59%*	*6.42%*
Development of rural areas	*4.61%*	*0.26%*	*1.15%*	*6.01%*
Large, SMEs and craft sector	*8.69%*	*3.85%*	*0.37%*	*12.91%*
Tourism	*2.18%*	*0.99%*	*0.25%*	*3.42%*
Research	*3.49%*	*1.11%*	*0.14%*	*4.74%*
Human Resources	16.50%	1.18%	13.24%	30.92%
Basic Infrastructure	28.03%	3.18%	1.20%	32.42%
Transport	*13.49%*	*0.65%*	*0.37%*	*14.51%*
Telecommunications	*2.57%*	*0.36%*	*0.29%*	*3.22%*
Energy	*0.70%*	*0.10%*	*0.04%*	*0.84%*
Environmental Infrastructure	*4.59%*	*0.45%*	*0.12%*	*5.15%*
Other	*6.68%*	*1.62%*	*0.39%*	*8.70%*
Miscellaneous	1.58%	0.57%	0.98%	3.14%
Total	70.90%	11.17%	17.93%	100.00%

*Objective 3, fisheries outside objective 1 and Community Initiatives.

Source: Annex to the Report on the Structural Funds 2004

Table 3: Use of Structural Funds in the 2000-06 period by Objective and field of intervention.

Table 2 shows this functional allocation of the ERDF and the other structural Funds. The ESF is invested in enhancing Human Capital, through Educational and Labor Market policies. The EAGGF and FIFG are in the first two subcategories of productive environment, while the ERDF includes all the basic infrastructure plus other productive expenditures affecting private sector reconversion, Tourism and Research and development.

[11] Interreg III is intended to support inter-regional cooperation, specially integrating remote regions and those that share borders with candidate countries. Urban II is the initiative for substainable development in the troubled urban districts of the EU.

As for the Cohesion Fund, it finances projects regarding environmental policies (focusing particularly on waste management, waste water treatment and water supply) and transport (therefore it would fit in the category "Basic Infrastructure" in the table above). It is invested in the least wealthy member states (Greece, Portugal and Spain. Ireland until 2003. Ten new members since 2004). In 2004, around 51.8% of the CF was invested in Transportation projects while the remaining 48.2% was devoted to environmental investment.[12]

4.3 Matching Grants.

The grants are not distributed unconditionally among states. In fact, there is quite a long administrative process before the Funds are effectively paid. They are allocated according to action programmes whose priorities are identified in cooperation with the European Commission. The choice of measures and the practical projects is the sole responsibility of the Member States.

The European Council decides under proposal of the European Commission on the budget of the Structural Funds, the rules governing their use and the allocation country by country and by priority objective. The approximate allocation of the Funds to be received by every Member Country and Objective area for a period of six to eight years is, therefore, the result of tense negotiations between the Member States.

Following certain common thematic guidelines proposed by the Commission, each Member Country has to negotiate with the Commission on the concrete plans. From this point onwards, national and regional authorities are responsible for the planification and implementation of concrete programmes, about which the European authority make a preliminary control to check that they fit in the plan before the implementation, and supervise the progress of the programmes.

The Structural Fund contribution never finances the whole cost of the program, but only a part of it.[13] The amounts negotiated by each Council are therefore conditional on the performance of the national and regional authorities that have to run the specific projects.

[12] 2 889 and 2 685 million Euro respectively (European Commission (2005b)).

[13] The General ceilling is a maximum of 75% of the total cost of the project (85 % for areas covered by the Cohesion Fund) in objective 1 areas and 50% in the rest. Those ceilling are revised when the project includes investment in firms (35% in Objective 1 areas and 25% in Objective 2) or with regard to investment in infraestructure generating substantial revenue (50% under Objective 1 and 25% under Objective 2) (European Commission (1999)).

4.4 The Performance of the Member Countries.

4.4.1 Previous evaluations of the effectiveness of the Cohesion Policy.

The map of the geographical areas that are the target of structural actions in the several programs run by the EU, has remained unchanged through the several programs.[14] It therefore becomes difficult to interpret the extent to which these structural actions have been useful for the achievement of the desired catching-up effect, especially since most of the policies might only show their effects on the long run. Studies trying to evaluate the impact of European Structural Funds in Objective 1 regions are not in general very optimistic. Dall 'Erba and Le Gallo (2003) use a model that controls for spatial spillover effects among regions, since they detect the presence of a growth diffusion process, especially on the core regions of the EU. They suggest that the small extent of spillover effects in pheripheral regions could be an explanation of their backwardness, and that even greater targeted funds do not allow spillovers in periphery. Rogríguez-Pose and Fratesi (2004) use panel data analysis to identify the lack of upward mobility of assisted regions and the absence of regional convergence. They think that the failure of the EU Structural policy may come from the excessive skewness towards infrastructure and business support of development strategies in Objective 1 regions.

There are also some more optimistic results, especially in studies focused on particular member countries. Percoco (2005) analyses the effect of the Structural Funds on the economic growth of the Italian Objective 1 regions. He found that induced growth rates vary highly across regions. He argues that is because regions investing through a marginal productivity rule are the ones experiencing best performance in terms of output increase. The results in De la Fuente (2003) for the Spanish regions are even more optimistic. Using a similar framework, he suggests that the impact of the Structural Funds in Spain has been quite sizable, adding around a percentage point to annual output growth in the average Objective 1 region and 0.4 points to employment growth.

4.4.2 The Performance of Public Investment.

In this paper we look into the public response to the Structural Funds as an intermediate stage to understand the effectiveness of the Cohesion Policy. The question of whether the structural actions are reinforcing the investment policies run by member states and their regions, or whether on the contrary, they are substituting their own resources with those from the EU might help us to yield

[14] 1994-1999 and 2000-2006. The regulations for the period 2007-2013 are already aproved.

conclusions about whether the European policies are properly designed to reach the desired catch-up effect.

In appendix I we show a detailed analysis of the evolution of public expenditure in two groups of countries. On the one side are the four countries that have been the main beneficiaries of the Structural Funds- Greece, Ireland Spain and Portugal. On the other side are the five countries that have received fewer Funds in per capita terms- Denmark, France, Luxembourg, The Netherlands and Sweden. The joint analysis of per capita public expenditure for some specific functional categories is shown in figure 2. This reveals that while most of the categories of public expenditure that could be considered public consumption (health or education, for example) have maintained their relative differences among both groups of countries, the gap for public expenditure in "Economic Affairs" has been considerably reduced for the time period considered. "Economic Affairs" includes most of the 'productive ' activities, such as infrastructures in transport, communication or energy. One could expect that most of the activities financed by the Structural Funds, concretely by the ERDF and the CF, will be included under this denomination.

Attending to the economic classification of public expenditure we look at public investment. Public investment includes public expenditure devoted to any functional category, but exclusively spending on gross fixed capital formation. This covers in particular machinery and equipment, vehicles, dwellings and other buildings. These are precisely the target of the main financing projects included in the Social Cohesion policy (with the exception of the ESF). We show in figure 3 in Appendix II how in our sample period the differences in public investment per capita have slightly decreased between the two groups of countries. We could even infer some preliminary conclusions about the simultaneous behavior of the gap in public investment per capita and Structural Funds expenditure. The gap seems to be reduced in the periods in which the amount of Funds increases and remains steady in those periods in which the expenditure of Structural Funds per capita decreases.

5 Data and variables.

5.1 Dependent Variable. Increase in Public Investment

We use the first difference of Public Investment as the dependent variable, expressed in millions of Euro. This is obtained from Eurostat, in which it is defined as public expenditure on gross fixed capital formation, consisting of net acquisitions of fixed tangible or intangible assets. This covers, in particular, machinery and equipment, vehicles, dwellings and other buildings. It also includes certain

additions to the value of non-produced assets realized by productive activity. This covers mainly improvements to land, such as draining of marshes.

5.2 Explanatory Variables. Determinants of Public Investment

The main variable, EUSF, includes the increase in payments of transfers from the European Union budget to the member states under the concept of any of the Structural Funds of the Cohesion Fund. We have seen in tables 2 and 3 that the main focus of the Structural Actions is to promote public expenditure in capital formation, with the important exception of the European Social Fund which promotes expenditure in education policies. The ESF is therefore subtracted from our variables, leaving the other Structural Funds (ERDF, EAGGF and FIFG) plus the Cohesion Fund.

The rest of the control variables have been selected on the basis of previous studies determining the main forces driving public investment. The degree of population density or of urbanization has been shown to be an important determinant of the necessities of public investment for middle and low income countries (Sturm (2001), Randolph, Bogetic and Hefley (1996)). However in our panel of European countries there are no significant shifts of this variable among units, and its inclusion would not add useful information to the panel. But we have included Population growth among our control variables as a determinant of public investment. A growing population would naturally increase its demand for some selected categories of public investment, in telecommunications for example. Simultaneously, the scale effects of some other categories of investment, like infrastructures, could imply that per capita necessities decrease as population grows. We do include population (in first differences, population growth) in our set of control variables.

The actual stock of public infrastructure is a natural determinant of current infrastructure expenditure needs. Assuming diminishing returns to public investment the level of stock of public capital would affect negatively the demand for additional investment, although it should be taken into account that due to depreciation there would be an additional demand for public expenditure to replace existing infrastructures. The final effect is not clear and depends upon the relative strength of opposite forces (Randolph et al. (1996)). Time-independent variables can accounted for by the unit specific term, so we do not have to explicitly include them.

variable	Label	Definition	Units	Source
Public Investment	**Pinv**	Gross fixed capital formation, sometimes simply referred to as investment, consists of resident producers acquisitions, less disposals, of fixed tangible or intangible assets	Mill. €	GFS (Eurostat). Years 1993 and 1994 from Eurostat in % GDP and then converted.
EU Structural Funds	**EUSF**	EU expenditure executed corresponding to Structural funds, by Member State.	Mill. €	EU (budget), several years, Allocation of EU expenditure by Member State
Real GDP growth	**GDPgr**	Real GDP growth	%	Eurostat
Public Consumption	**PCons**	(ESA95 code P.3) Expenditure incurred by resident general government units on goods or services that are used for the direct satisfaction of individual needs or wants or the collective needs of members of the community. May take place on the domestic territory or abroad.	Mill. €	Eurostat
Private Investment	**PrivInv**	Gross fixed capital formation (GFCF) consists of resident producers' acquisitions, less disposals of fixed assets plus certain additions to the value of non-produced assets. The private sector consists of non-financial corporations, financial corporations, households and non-profit organizations serving households	Mill. €	Eurostat
Population growth	**Pop**	Population growth	Miles peo ple	Eurostat
Public Balance	**Pbal**	Net borrowing (+)/net lending (-) of general government is the difference between the revenue and the expenditure of the general government sector. GDP used as a denominator is the gross domestic product at current market prices.	% GDP	Eurostat

Table 4: Variables and data sources.

The rate of production growth is traditionally included as a determinant of public expenditure.[15] It has been argued that the income elasticity of the demand of some public goods could affect the allocation of public expenditure as growth rates fluctuate. (This is a version of Wagner's Law) It could also take cyclical factors into account, especially when there is no other variable attached to the business cycle in the model.

Restrictive fiscal policy measures may also be induced by high levels of budget deficits or government debt. Roubini and Sachs (1989) show that capital expenditures suffer more drastically under the implementation of these restrictive fiscal policies. This is a consequence of the fact that very often this kind of expenditure is less rigid than other public expenditure categories(De Haan et al (1996)).

[15] See for example Miller and Russek (1997), Kneller, Bleaney and Gemmell (1999) Bose, Haque and Osborn (2003),

The results in Kneller et al. (1999) suggest that we should also include a variable to account for the public spending not devoted to investment. Increases in the level of public consumption and in general, in the spending possibilities of the country should naturally have an effect on Public Investment. We consider Public Consumption as an indicator of the variations of the spending capacity in the budgets of the public bodies of the country.

There have been several studies trying to link political variables to the tendency to alter patterns of public spending. The political variables that could affect government spending might be the kind of party in power, the kind of government (coalition, majority government or minority government) and the political influences of lobbying. The more conclusive results have been found in studies that link the influence of political variables on the level of public spending (Roubini and Sachs (1989)) or debt-related issues.[16] However, studies focused on public investment have not been able to find any significant link of the current level of public investment with political variables. We recall here the results in Sturm (2001), for non OECD countries, De Haan, Sturm and Sikken (1996), for OECD countries, and Mizutani and Tanaka (2005), who use regional data from Japan prefectures. Therefore, we do not include any political variable among our set of controls.

	Obs.	Mean	St. Dev.	Min	Max
Pinv	178	378.93	1727.1	-7948.7	11365
EUSF	180	64.136	636.99	-2451.8	2879.9
GDPgr	195	2.9558	2.4616	-2	16
PCons	177	4856.87	6973.03	10483	41184
PrivInv	162	4033.90	8079.85	-28797	36838
Pop	195	99.961	144.40	-62.9	720.2
Pbal	175	748.64	11417	-85980	56992

Table 5: National Data. Summary Statistics

[16] De Haan and Sturm (1997), see Sturm (2001) for a detailed literature review

6 Empirical Model and Results.

6.1 Econometric model.

To test the hypothesis that public investment may be affected by European Structural Funds ' grants, we have constructed a model in which the dependent variable is the public investment made by the consolidated government, including central, regional and local governments as well as social security funds, I_{it}. The set of explanatory variables (X_{it}) includes our main variable of interest, EU Structural Funds allocated to the member country "i " in the current year "t ", s_{it}.[17] We have also introduced in the model other control variables: GDP, population, public balance, public consumption and private investment, included in the vector c_{it}.

$$I_{it} = \beta_1 s_{it} + \beta_2 c_{it} + \eta_i + u_{it} \tag{2}$$

$$X_{it} = \{s_{it}, c_{it}\} \qquad \beta = \{\beta_1, \beta_2\}$$

All variables have been included in first differences to avoid the probable nonstationary behavior of many of them. We also suspect of serially correlated error term, due to the nature of the variables and the length of the time dimension of the sample. T-statistic to control for this possibility are reported in next subsection**.** This motivates the inclusion of an autocorrelated error in model 2:

$$u_{it} = \rho u_{it-1} + \varepsilon_{it} \qquad where \qquad \varepsilon_{it} \tilde{} N[0, \sigma_e]$$

The original model in equation 2 has been estimated in the presence of serially correlated errors, but under the assumption of strict exogeneity of the explanatory variables, i.e.

$$E[x\prime_{is}, u_{it}] = 0 \qquad t, s = 1, 2, ...T.$$

[17] The coefficient β_1 represents in our neoclassical framework presented in section 2 the increase in public investment compresed the grant $(\Delta(g_{sub} + g_{nonsub}) + (1-\delta)g_{sub})$ in relation to the increment on the grant $(\Delta(1-\delta)g_{sub})$. In practice would be represented by the relation: $[1+\frac{\delta^{\alpha s-1}-1}{(1-\delta)\delta^{\alpha s-1}}]+[\frac{\alpha_{sub}}{\alpha_{nonsub}}\frac{\delta^{\alpha s-1}-1}{(1-\delta)\delta^{\alpha s-1}}]$, where the first braket represents the (crowding-in) effect in the subsidized capital while the second braket includes the (crowding-out) effect on non subsidized capital.

This assumption may be considered too strong for our model. Especially after the results in Knight (2002), the allocation and execution of the structural funds may be thought to respond to some unobserved necessities and cojuncture

that parallelly drives decisions on public investment.

The immediate solution to the problem would be to find some instrumental variables correlated to structural funds but orthogonal to public investment. Alternatively, we can use lags of the dependent and explanatory variables as instruments. The GMM estimation method developed by Arellano and Bond (1991) relies on the orthogonality of the dependent and explanatory variables with the first differences of the error component in posterior periods. This method allows us to include endogenous and predetermined dependent variables. These GMM methods construct moment conditions that reflect this orthogonality, under assumption of serially uncorrelated shocks, error components and predetermined initial conditions.[18] The problem would be, therefore, that we have previously admitted the possibility of the existence or AR(1) errors in the original model [3.2], which implies that lagged values of i_{it} and x_{it} are correlated with past shocks and the moment conditions that should be used, $E[i_{it-s}\Delta u_{it}] = 0$[19] and $E[x_{it-s}\Delta u_{it}] = 0$[20] are no longer valid.

But we can still transform the static model 2 to obtain a dynamic representation with serially uncorrelated shocks.

$$I_{it} = \beta_1 s_{it} + \beta_2 c_{it} + \eta_i + u_{it} \qquad where \qquad u_{it} = \rho u_{it-1} + \varepsilon_{it}$$

$$\rho I_{it-1} = \rho\beta_1 s_{it-1} + \rho\beta_2 c_{it-1} + \rho\eta_i + \rho u_{it-1}$$

$$I_{it} = \rho i_{it-1} + \beta_1 s_{it} - \rho\beta_1 s_{it-1} + \beta_2 c_{it} - \rho\beta_2 c_{it-1} + (1-\rho)\eta_i + \varepsilon_{it}$$

This is a dynamic model with serially uncorrelated shocks that we can estimate using Arellano and Bond (1991) GMM estimator for dynamic panels. The explanatory variables are correlated with the individual effects and are predetermined or endogenous with respect to the serially uncorrelated shocks ε_{it}. Note that the original betas are still the long-run relationship if we assume long-run stability, with $i_{it} = i_{it-1}$, $s_{it} = s_{it-1}$ and $c_{it} = c_{it-1}$.

[18] $E[\eta_i] = E[u_{it}] = E[\eta_i u_{it}] = 0$, $E[u_{is}u_{it}] = 0$ *for* $s \neq t$ and $E[y_{i1}u_{it}] = 0$ *for* $t = 2, ...T$.respectively.

[19] for t=3,...T and s$\geq$ 2

[20] t=3,...T and s$\geq$ 2 if x_{it} contains endogenous variables. If they are predetermined or strictly exogenous there would be a larger set of moment conditions available.

6.2 Estimation results.

We consider two alternative sets of explanatory variables. Columns [1] to [3] show the results in the model with GDP growth, public consumption and private investment while columns [4] to [6] include in addition population growth and public balance. Columns [1] and [4] show the results for the fixed-effects model while columns [2] and [5] are the random-effects coefficients.

The difference between both, fixed-effects and random-effects estimation models are almost imperceptible. In fact, when we run the Hausman test to both estimators, we cannot reject the null of no systematic difference in coefficients in both cases.[21] We therefore expect correlation between the individual specific effects and the error term not to be problematic in our model. Also as expected, random-effects estimation yield narrower standard errors.

Both static models include autocorrelated errors, since the results of the Baltagi-Wu test and the modified Durbin-watson test proposed by Bhargava et al. (1982) suggest the presence of autocorrelated errors. The results of the F-test allow us to reject the null of no significant difference among the group effects.

	(1)	(2)	(3)	(4)	(5)	(6)
	F-E	*R-E*	*GMM-ABond*	*F-E*	*R-E*	*GMM-ABond*
EUSF	**0.6141*** (.192)**	**0.6979*** (.176)**	**0.6350*** (.188)**	**0.5760*** (.201)**	**0.6097*** (.182)**	**0.5681*** (.194)**
GDPgr	90.35 (66.80)	89.64 (54.90)	166.75** (65.56)	95.45 (68.86)	106.45** (54.17)	159.02** (66.29)
PCons	0.0854*** (.025)	0.0887*** (.022)	0.0739*** (.023)	0.0824*** (.030)	0.0696*** (.025)	0.0646*** (.024)
PrivInv	-0.0718*** (.019)	-0.0498*** (.018)	-0.0563*** (.017)	-0.0767*** (.024)	-0.0572** (.022)	-0.0545*** (.017)
Pop				1.8798 (1.66)	3.2090*** (1.12)	1.927 (1.370)
Pbal				0.0049 (.012)	0.0033 (.011)	15.293 (57.35)
F-test group eff.	*2.32 (Prob>F=.0 071)*			*1.57 (Prob>F=.09 83)*		
Tests autocorr. err.	*Mod. Durbin-Watson = 2.173 Baltagi-Wu = 2.249*		*A-B t. order 1 -7.51 (P = .00)* *A-B t. order 2 0.12 (P = .90)*	*Mod. Durbin-Watson = 2.226 Baltagi-Wu = 2.3036*		*A-B test o. 1 -7.57 (P = .00)* *A-B t. order 2 0.32 (P = .74)*
Sargan test over. restr.			*139.82 P > Ch2= 0.325*			*139.53 P > Ch2= 0.999*
Obs.	*147*	*162*	*133*	*144*	*159*	*133*

Table 6: EU Structural Funds Crowd-out. National-level data: EU 15.

[21] The test-statistic takes a value of 7.72 for the first model and 3.46 for the second.

Columns [3] and [6] report estimation results for the dynamic model [], estimated using the Arellano and Bond (1991) GMM estimator. Again, the differences in the results are not dramatic in comparison to those obtained previously. Endogeneity thus seems not to be a problem in our case, in contrast to Knight (2002). This may be related to the different decision processes in the allocation of aid. Knight (2002) is able to describe how, for his data, State governments have a certain level of influence in the Federal Highway program grants ' allocation, so that states with a higher preference for investment in highways would be able also to push harder in the committee that allocates the grants.

Our case is slightly different. The broad numbers are negotiated in the European Council for a long period, according to general rules of identical application to all member countries in accordance with their economic, social and geographical situation. But the actual application of the policies is supervised by the European Commission. The bargaining power of member states to get additional resources at this stage is practically inexistent.

The results from our regressions are also quite different from Knight (2002) and reasonably consistent with a large part of the literature. Unlike him, we reject the total crowding-out hypothesis and conclude that endogeneity is not as problematic as he claimed. Obviously, the main explanation for this disagreement is the different nature of the data and the political economy environment from which they come. The discussion about the endogeneity of the allocation of grants in the case of the Federal Highway program might be related to the decision to consider them lump-sum grants instead of matching grants, as long as they are highly correlated to the preferences of the state governments.

In general, the results concerning our variable of interest, EUSF, do not differ among regressions. The inclusion of population and public balance among the set of explanatory variables, although suggested by the literature, do not add much relevant information in our case. On the contrary, in the dynamic model the Sargan test reports a rejection of the null of the validity of the instruments used as a consequence of the inclusion of these two variables.

We can conclude that there is not total crowding-out from Structural Policies. Member countries increase their public investment around 60 percent of the received funds. However, with these results we cannot say that there is absolutely no deviation of public expenditure, since the estimated coefficients are also smaller than one.

If we interpret these results using the theoretical framework described in Section 2, we can say that the matching process established by the European Commission after the negotiation in the European Council works reasonably well, so that member states do not consider the Structural Funds as unconditional grants, even if the amount allocated has already been decided previously.

If those funds were considered by subsidized governments as lump-sum transfers, we would expect a negative coefficient associated with the variable EUSF, although a perfect matching system should yield a coefficient larger than one. In addition, also according to the theoretical model, this result does not tell us whether to ensure that the type of capital subsidized is more effective in terms of enhancing economic growth.

6.3 An alternative view: Implementation on Spanish regional data

In this subsection we want to study the problem from a regional perspective. With data from the Spanish regions, we will estimate the extent to which Structural Funds incentive public investment at the regional level.

Spain is a country with a reasonably high level of fiscal decentralization, in which regional governments have a large leeway to decide on investment decision. They control over 30 percent of the public budget. There is also a contrast between poorer southern regions which perceive an important amount of Structural Funds (many of them are among the Objective 1) while the northern regions are in general richer. Table 7 describes the variables used in the regression. Their definition is very similar to the variables for national data.

variable	*Label*	*Definition*	*Source*	*Units*
Public Investment	**Pinv**	Capital Expenditure	Badespe database, Instituto de Estudios Fiscales	Miles €
EU Structural Funds	**EUSF**	Transfers from the European Union to the capital account of the regional governments	Badespe database, Instituto de Estudios Fiscales	Miles €
Real GDP growth	**GDPgr**	Gross domestic product (GDP)at current market prices at NUTS level 2	INE	FD,miles €
Public Consumption	**PCons**	Current Expenditure	Badespe database, Instituto de Estudios Fiscales	Miles €
Private Investment	**PrivInv**	Private Gross Fixed Capital Formation	Eurostat	Million €
Population growth	**Pop**	Population at first of January	Eurostat	people
Central government capital expenditure	**Cgcape**	Central Government Gross Fixed Capital Formation expenditure	Spain: Badespe	Million €

Table 7: Variables and Sources of Regional Data.

The model has been slightly accommodated to the regional data. The main difference with the one used for the country-level data is the elimination of the variable "Public balance" and the inclusion of "Central Government Capital Expenditure". The inclusion of indicators of public deficits would not add relevant information since sub-national levels of government are usually quite constrained to incur into deficit. Alternatively, as suggested by our findings on chapter 2, the behavior of the central government as an investor could influence the policies run by sub-national governments regarding public expenditure.

The fiscal variables included exclusively concern regional governments. We rely on fewer observations than in the regression with national data, due to the reduced range of years for which the variable EUSF is available and to the lack of data for private investment before 1995. The summary statistics describing the variables are in Appendix III.

	(1)	(2)	(3)	(4)	(5)	(6)
	F-E	*R-E*	*GMM-ABond*	*F-E*	*R-E*	*GMM-ABond*
EUSF	**0.6718*** (.131)**	**0.6820*** (.122)**	**0.6968*** (.128)**	**0.6448*** (.141)**	**0.6591*** (.122)**	**0.6143*** (.122)**
GDPgr	0.0359** (.014)	0.0301*** (.006)	0.0320** (..013)	0.0336 (.023)	0.0264*** (.006)	0.0228 (.015)
PCons	0.0082 (.034)	-0.0138 (.028)	-0.0222 (.027)	-0.0130 (.035)	-0.0049 (.029)	-0.0158 (.026)
PrivInv	-0.0338*** (.011)	-0.0290*** (.010)	-0.0278*** (.009)	-0.0332** (.012)	-0.0295*** (.010)	-0.0238** (.009)
Pop				0.2727 (.601)	0.3061 (.196)	0.4559* (.248)
CGcape				0.0243 (.050)	0.0089 (.041)	0.0376 (.042)
F-test group eff.	1.72 (Pr>F=.064)			1.72 (Pr>F=.066)		
Tests autocorr. err.	Mod. Durbin-Watson = 1.972 Baltagi-Wu = 2.366		A-B t. order 1 -5.97 (P = .00) A-B t. order 2 -0.07 (P = .04)	Mod. Durbin-Watson = 2.023 Baltagi-Wu = 2.400		A-B test o. 1 -7.61 (P = .00) A-B t. order 2 0.30 (P = .13)
Sargan test overid. Restrict.			88.77 P > Ch2= 0.0268			91.35 P > Ch2= 0.017
Obs.	86	103	86	86	103	86

Table 8: EU Structural Funds Crowd-out. Regional Data: Spain.

We have to be prudent while interpreting the results, especially taking into consideration the reduced length of the sample. Some of the specification tests yield adjusted test-statistics (in particular, the second order autocorrelation test in column 3). The estimation of the effects of EUSF are almost identical among models. The estimated effect is also very close to the one estimated with the country-level data, although we have to keep in mind the difference in the definition of the variables. It looks like regional governments in Spain do accommodate their budgets to the income from the Structural and Cohesion Funds in a similar way to our sample of European nations.

Regarding the rest of the explanatory variables, we can also check how the Spanish data replicate quite accurately the results obtained with national data, except the coefficients estimated for Public consumption. We find this coefficient insignificant for Spanish regions while it is an important determinant of public investment at the national level. The interpretation for this it not straightforward. Given that this variable is an indicator of the public budget or the 'availability of funds', it might be that regional governments find themselves less constrained to enlarge their investment. As for "GDP" and "Private Investment", the results are quite similar to those estimated with national data and reveal how the public administration tries to compensate for the lack of private capital.

These estimations imply that the larger propensity to consume of regional governments does not affect their reaction towards EU grants. In other words, the matching grants system run by the European Commission works with the same effectiveness at this level of the public administration.

7 Conclusions.

This paper evaluates the response of public governments to EU Cohesion policy. In particular, we estimate the impact of Structural and Cohesion Funds on public expenditure, and conclude that member countries increase their public investment around 60 percent of the new Funds received. Therefore, there is a small crowding-out effect of those funds on public investment. The system of "matching grants" used by the European Commission to allocate the funds seems to work reasonably well. We describe in the paper how the European Commission has developed a system in which grants are given conditional on public investment made by the public governments. This system of matching-grants have partly succeeded in enhancing public investment in less developed countries inside the Union.

With the help of a simple version of a neoclassical growth model, we interpret the coefficient estimated as an indicator of the effectiveness of the matching grants system designed for the Funds. According to our model, the estimated coefficient should be larger than one if the Funds were completely administrated as matching grants, while it would take a negative value if they were considered unconditional transfers. Taking into account the bargaining process in the European Council according to which the Funds are distributed, it would not be surprising that the majority of these Funds were considered by subsidized countries as lump-sum transfers.

The relevant literature developed since the early seventies, especially that using US data, forecast similar reactions to federal grants. However, more recent studies have questioned the validity of these results by suggesting the necessity of taking into account the possibility that the variables that define the allocation of grants are endogenous. We estimate the efficiency of to the particular case of the Structural Funds, setting up a dynamic model estimated using the GMM Arellano-Bond estimator for panels that takes into account for the possibility of endogeneity.

The paper also investigates whether more disaggregated levels of data might reveal deeper information. In particular, the fact that regional governments could have a different pattern of behavior towards the grants. We cannot identify a different response from the regional administrations to the EU Structural Policy. However, more investigation needs to be done with regional data to find out whether there are substantial differences in the behavior of public expenditure towards EU Structural grants among countries.

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8 Appendix I Public Grants in a neoclassical model with fixed tax rate.

8.1 Basic framework, the model without grants.

For simplicity, we choose to set up a discrete-time model with a unique final good. We consider a single, infinitely lived representative household. Aggregate output, Y, is produced with private physical capital, k, and two types of public infrastructure services, g_1 and g_2, using a Cobb-Douglas technology represented by the production function:

$$Y_t = Ak_t^{\gamma} g1_t^{\alpha 1} g2_t^{\alpha 2} \tag{3}$$

where $\gamma = 1-\alpha 1-\alpha 2$, $\alpha 1 > \alpha 2$, and $A > 1$.

Thus, production exhibits constant returns to scale in all factors. There is total depreciation in all three inputs.

The behavior of the representative consumer

The household-producer maximizes the discounted stream of future utility:

$$U_s = \Sigma_{t=s}^{\infty} \beta^s [\ln c_t] \tag{4}$$

where c_t represents private consumption in period t. The consumer ignores the present and future decisions of the public government about g1, g2 and g3. He faces the budget constraint:

$$(1-\tau)Y_t = C_t + K_{t+1} \tag{5}$$

The maximization problem yields the euler equation:

$$\frac{C_{t+1}}{C_t} = \Pi_c = \beta\gamma(1-\tau)\frac{Y_{t+1}}{K_{t+1}}$$

Which we expect to be constant in the steady state.

The behavior of the government.

The government is able to observe the behavior of the consumer. However, it does not internalize the consumer's problem,[22] but seeks maximize the utility received by the median voter from the publicly provided public good, g3. Therefore, its utility function will be:

$$U_s = \Sigma_{t=s}^{\infty} \beta^s [\ln G3_t] \tag{6}$$

Production is taxed at the rate $\tau \in (0,1)$.The government distributes the public budget among public consumption, $g3_t$ and public capital accumulation for next period, $g1_t$ and $g2_t$.Thus, its budget constrain will be:

$$\tau Y_t = G1_{t+1} + G2_{t+1} + G3_t \tag{7}$$

We have included two types of public capital to be able to compare the different response of public expenditure when either of them is subsidized. Let us assume now that an external agent, a higher level of government, for example, is interested in boosting economic growth by subsidizing the purchase of one of both types of public capital to the public sector through a matching grant. The matching grant would be transcribed in our model as a change in the relative price of public capital in the budget constraint of the public sector. Equation 7 would then become:

$$\tau Y_t = \delta_1 G1_{t+1} + \delta_2 G2_{t+1} + G3_t \tag{8}$$

where δ_1 and $\delta_2 \in (0,1)$ represent the share of cost that the public sector has to pay on the purchase of both types of public capital, $G1$ and $G2$ respectively, after the implementation of a matching grant system. The subsidizer would pay the remaining (1-δ_1)$G1$ and (1-δ_2)$G2$. The parameters δ_1 and δ_2 would take the value 1 if either $g1$ or $g2$ **are** not subsidized respectively.

The government maximizes the discounted present value of lifetime utility, 4, subject to technology, 3, and the budget constraint **??**. The maximization problem yields the following euler equations:

[22] Identically to the second chapter, we introduce this assumption for simplicity, since it is equivalent to assume a model with public policy decided by a representative consumer applying median voter theory, in which the utility function includes private consumption and public services additively separable, in line with Agenor (2007), Ganelly and Tervala (2007) and Van der Ploeg and Bovenberg (1994), among others. We recall again the analysis by Djajic and Maximilians (1987) that includes an interesting analysis of the implications of alternative assumption concerning the relationship between public and private consumption in the utility function.

$$\frac{G3_{t+1}}{G3_t} = \Pi_g = \beta\tau\frac{\alpha_1}{\delta_1}\frac{Y_{t+1}}{G1_{t+1}} \tag{9}$$

$$\frac{G3_{t+1}}{G3_t} = \Pi_g = \beta\tau\frac{\alpha_2}{\delta_2}\frac{Y_{t+1}}{G2_{t+1}} \tag{10}$$

Equilibrium

It is easy to check that this economy will find its equilibria where the growth rates for consumption and public expenditure are identical, $\Pi_g = \Pi_c = \Pi$. We can then substitute and work out the constant growth rate in equilibrium:

$$\frac{C_{t+1}}{C_t} = A\beta(1-\tau)^{\gamma}\tau^{1-\gamma}\frac{\alpha_1^{\alpha_1}\alpha_2^{\alpha_2}\gamma^{1-\alpha_1-\alpha_2}}{\delta_1^{\alpha_1}\delta_2^{\alpha_2}} \tag{11}$$

As long as $\Pi>1$, there is a constant rate of consumption growth, which is entirely independent of the level of capital stock per person. This will also imply that there are no transitional dynamics in this model. Starting from any level of initial wealth the economy will immediately start growing at a constant rate. We have to impose the additional condition $A > \frac{1}{\beta(1-\tau)^{\gamma}\tau^{1-\gamma}\alpha_1^{\alpha_1}\alpha_2^{\alpha_2}\gamma^{1-\alpha_1-\alpha_2}}$ to ensure positive economic growth.

We can now derive the relative amounts of the production factors used in equilibrium:

$$\frac{K_{t+1}}{Y_t} = \beta\gamma(1-\tau); \qquad \frac{G1_{t+1}}{Y_t} = \frac{\beta\alpha 1\tau}{\delta_1}; \qquad \frac{G2_{t+1}}{Y_t} = \frac{\beta\alpha 2\tau}{\delta_2}$$

and the relative amounts of consumption goods:

$$\frac{C_t}{Y_t} = (1-\tau)(1-\beta\gamma); \qquad \frac{G3_t}{Y_t} = \tau(1-\beta\alpha 1-\beta\alpha 2)$$

The relative amount of wealth devoted to non-subsidized production factors remains unchanged.[23] However, the actual proportion of production allocated to them is slightly smaller, since production grows faster than in the situation without grants. They experience, therefore, a decrease caused by the wealth

[23] This is a consequence of our constant elasticity of substitution production function.

effect, similar to the one that would be caused by a lump-sum transfer equivalent to the grant.

The subsidized factors, on the contrary, will experience an increase in their relative share of wealth. They are also affected by the wealth effect induced by the faster growth, but the crowding-in provoked by the decrease in the relative price of the factor will always be larger.

The following equation defines the response of public expenditure to the grants policy, $\Delta\frac{G_{sub}+G_{nonsub}}{Y}$, exclusive of the granted amount which is also invested. According to this definition, there is crowding-out of a matching-grant policy on public investment when the value of this expression is negative, while a positive value will imply that the policy crowds in public investment.

$$\boldsymbol{\Delta}\frac{G_{subsidized}+G_{nonsub}}{Y}=\boldsymbol{\beta\tau}(\frac{\alpha_{sub}+\alpha_{nonsub}\delta}{\delta^{1-\alpha_{sub}}\Pi_0}-\frac{\alpha_{sub}+\alpha_{nonsub}}{\Pi_0})=\frac{\beta}{\Pi_0}\tau[\boldsymbol{\alpha}_{sub}(\frac{1}{\delta^{1-\alpha_{sub}}}-\mathbf{1})+\boldsymbol{\alpha}_{nonsub}(\boldsymbol{\delta}^{\alpha_{sub}}-\mathbf{1}) \tag{12}$$

The first term inside the brackets represents the increment in the share of G_{sub} on production, due to the decrease of its relative price. The second term is negative, since $\delta_1^{\alpha 1} < 1$, and represents the decrease of the share of G_{nonsub} on production induced by the faster growth (wealth effect). The effect on the subsidized type of capital is larger than the negative wealth effect on non-subsidized capital. This expression will always be positive regardless of the values taken by $\boldsymbol{\alpha}_{sub}, \boldsymbol{\alpha}_{nonsub}$, and δ: the total increase on public investment will always be larger than the grant perceived by the subsidized government, which yields proposition 1:

We are in conditions therefore to ensure that in our neoclassical framework a matching-grant will always induce a crowding-in response in subsidized governments. We summarize this result under the name of proposition 1, that stands: "*In our model neoclassical technology, a matching-grant to one of the types of public capital will always induce a crowding-in effect onto public investment, regardless of the relationship of the output elasticity of the granted capital with that of the remaining production factors, and of the share of capital granted, δ.This means that there will be a positive increase in final public investment higher than the amount granted as a reaction to the transfer*".

We now turn to examining how the effects of the matching-grants policy depend on the relative coefficient α associated with the subsidized capital, which also represents the relative amount used of this type of capital in equilibria and its output elasticity. We compare the effects of allocating a determined matching grant to either one of the types of public capital in two alternative environments. First we will compare the effect of allocating the same δ to either, G_1 and G_2,

and later we will compare the results of allocating a grant δ_1 to an alternative grant δ_2, when both of them imply an equivalent cost to the subsidizer. Finally, we will also consider the case of an unconditional lump-sum transfer.

8.2 Case A, an identical grant to each type of capital.

First we will compare the different response of public expenditure to alternatively subsidizing G_1 or G_2 with a matching grant of identical value. That is, the subsidizer has to choose between the alternative of establishing $\delta_1 = \delta$ or $\delta_2 = \delta$.

If the external agent chooses to subsidize G_1, the new constant growth rate would be $\frac{\Pi}{\delta^{\alpha 1}}$ and the increment of public investment will be represented by the equation:

$$\Delta \frac{G1_{t+1} + G2_{t+1}}{Y_{t+1}} = \beta\tau(\frac{\alpha_1 + \alpha_2\delta}{\delta^{1-\alpha 1}\Pi_0} - \frac{\alpha_1 + \alpha_2}{\Pi_0}) = \frac{\beta}{\Pi_0}\tau[\alpha_1(\frac{1}{\delta^{1-\alpha 1}} - 1) + \alpha_2(\delta^{\alpha 1} - 1)] \tag{13}$$

If the external agent chooses instead to subsidize G_2 through an identical matching grant, the alternative constant growth rate would be $\frac{\Pi}{\delta^{\alpha 2}}$ and the increment of public investment will be represented by the equation:

$$\boldsymbol{\Delta} \frac{G1_{t+1} + G2_{t+1}}{Y_{t+1}} = \boldsymbol{\beta\tau}(\frac{\alpha_1\delta + \alpha_2}{\delta^{1-\alpha 2}\Pi_0} - \frac{\alpha_1 + \alpha_2}{\Pi_0}) = \frac{\beta}{\Pi_0}\tau[\boldsymbol{\alpha}_1(\boldsymbol{\delta}^{\alpha 2} - \mathbf{1}) + \boldsymbol{\alpha}_2(\frac{1}{\delta^{1-\alpha 2}} - \mathbf{1})] \tag{14}$$

For our range of possible values for the parameters, the value of equation 13 will always be larger than equation 14. The increment in economic growth will also be larger in the case of the matching grant to the first type of public capital g1. This result lead us to proposition 2 that stands: "*The response of a public authority to a matching-grants policy on a certain kind of public investment run by an external institution depends on the relative amount of this kind of public investment used previously. The higher the output elasticity of this kind of public investment with respect to the other production factors, the higher the increase in public expenditure induced by the grant*".

8.3 Case B, a grant with identical cost to each type of capital.

The case discussed above includes two options that are not perfectly comparable from the point of view of the subsidizer, since he would have to face a higher cost if he attached the matching grant to the more productive capital G_1 in comparison to the alternative of granting G_2. Alternatively, we may want to compare the outcome of allocating a grant to each one of the types of public capital that would imply an equivalent cost to the grant subsidizer. For that we have to choose δ_1 and δ_2, so that the cost of granting either G_1 or G_2 would be identical, that is:

$$(\mathbf{1}-\boldsymbol{\delta}_1)\frac{G_1}{Y}=(\mathbf{1}-\boldsymbol{\delta}_2)\frac{G2}{Y}. \tag{15}$$

We will denote any pair of coefficients δ_1 and δ_2 for which equation 15 holds as $\bar{\delta}_1$ and $\bar{\delta}_2$. In that case, the effect of implementing the grant system for each one of the alternatives would be given by the following expressions:

$$\boldsymbol{\Delta}\frac{G_{1t+1}+G_{2t+1}}{Y_{t+1}}=\frac{\beta}{\Pi}\tau[\boldsymbol{\alpha}_1(\frac{1}{\bar{\delta}_1^{1-\alpha 1}}-\mathbf{1})+\boldsymbol{\alpha}_2(\bar{\boldsymbol{\delta}}_1^{\alpha 1}-\mathbf{1})] \tag{16}$$

$$\Delta\frac{G_{1t+1}+G_{2t+1}}{Y_{t+1}}=\frac{\beta}{\Pi}\tau[\alpha_1(\bar{\delta}_2^{\alpha 2}-1)+\alpha_2(\frac{1}{\bar{\delta}_2^{1-\alpha 2}}-1)] \tag{17}$$

It is easy to show that for any pair $\bar{\delta}_1$ and $\bar{\delta}_2$ the outcome from equations 16 and 17 will always be identical. Therefore, we expect an identical effect on total public investment from either of the alternatives: implementing a grant $\bar{\delta}_1$ to the purchase of g1 or alternatively implementing a grant $\bar{\delta}_2$ to g2, provided that the relationship between δ_1 and δ_2 comes given by 15.

However they do not induce an identical effect on growth. The new constant growth rate would be $\frac{\Pi}{\bar{\delta}_1^{\alpha 1}}$ if we allocate the grant to G_1 and $\frac{\Pi}{\bar{\delta}_2^{\alpha 2}}$ if the grant is attached to G_2. Given $\alpha 1 > \alpha 2$, $\bar{\delta}_1^{\alpha 1}$ will always be smaller than $\bar{\delta}_2^{\alpha 2}$, therefore, the new growth rate would always be larger under a matching grant $\bar{\delta}_1$ attached to the first type of public capital, G_1, than under an alternative matching grant with value $\bar{\delta}_2$ attached to G_2. The provider of the grant would share the same

cost under both alternatives, but the first option would be more efficient in terms of growth-enhancement.

Proposition 3 characterizes this result: *"The cost to the subsidizer of running a matching grant policy with the purpose of reaching a predetermined increase of public investment does not depend on the output elasticity of the subsidized type of public investment. However, the higher this elasticity of the public investment, the higher the increase in economic growth induced by the reallocation of factors ".*

8.4 Case C. Lump-sum grants.

We also analyze the alternative case in which the government does not receive a matching grant, but a lump-sum grant.[24] Let us assume that the government receives no grant until period S, and that at that time it is announced that it will start receiving a permanent lump-sum quantity L from period s+1 onwards. Until period s, equation 11 (with $\delta_1 = \delta_2 = 1$) defines the constant growth rate in equilibrium for all variables. But in period s+1 the budget constraint 7 changes to:

$$\tau Y_{s+1} + L = G_{1s+2} + G_{2s+2} + G_{3s+1} \tag{18}$$

This implies that in period s, in order for equations 9 and 10 to hold, G_{1t+1} and G_{2t+1} should decrease to anticipate some public consumption from the future increase in public wealth. This will provoke a new rate of growth of g3, larger than Π_g described in equation 11, which we could name Π_{gS} :

$$\frac{G_{3s+1}}{G_{3s}} = \Pi_{gS} = \beta\tau\alpha_1 \frac{Y_{s+1}}{G_{1s+1}} = \beta\tau\alpha_2 \frac{Y_{s+1}}{G_{2s+1}}$$

From this moment onwards $\frac{G_{3t+1}}{G_{3t}}$ will start to decrease and converge to the value that it used to have before s. Parallelly, $\frac{G_{1t}}{Y_t}$ and $\frac{G_{2t}}{Y_t}$ will also increase to converge gradually to their previous value, or immediately if the grant were retired. The effect of the introduction of a lump-sum grant in period s+1 over G_{1s+1} and G_{2s+2} is:

$$\boldsymbol{\Delta} \frac{G_{1t+1} + G_{2t+1}}{Y_{t+1}} = \boldsymbol{\beta\tau}(\boldsymbol{\alpha}_1 + \boldsymbol{\alpha}_2)\left(\frac{1}{\Pi_{gS}} - \frac{\mathbf{1}}{\Pi_g}\right)] \tag{19}$$

[24] Given that there is perfect mobility among the three categories of public expenditure, we can also suposse that the lump-sum transfer is of any kind of public good.

The value of this expression will always be negative since $\Pi_{gS} > \Pi_g$. Therefore, the introduction of the lump-sum grant not only does not induce an increment in public investment larger than the sum of the grant received, as happens with the matching grants, but conversely withdraws resources from public capital. This happens because the government anticipates public consumption in period S from the increase in wealth in S+1 induced by the transfers, which pushes down public investment for period s+1 (decided on period s). The level of production of the economy will also decrease.

This result drives proposition 3: "*In our economy with neoclassical technology and a fixed tax-rate, a lump-sum transfer to the government from an external agent will induce a deviation of public resources from public investment towards public consumption such that the government will increase public consumption by a quantity higher than the transfer received. Therefore, there will be a negative increase in final public investment as a reaction to the transfer* ".

We could define the result of a lump-sum transfer of capital described in proposition 4 as a situation of total crowding-out, because we have a negative increase in total public investment. This result justifies many findings of the flypaper literature summarized in section 3. The assumption of fixed tax rate has consequences for the relationship between public and private consumption, but the main mechanism is driven by the decrease in marginal utility of consumption induced by the grants, which pushes down the equilibrium amounts of production factors.

9 Appendix II

Portugal, Greece, Spain and Ireland are clearly the main beneficiaries of the Structural Funds. Figure [1] shows the allocation per capita of the Structural Fund for the 15 European countries in our dataset. The allocation to Greece or Portugal is clearly above 200 Euro per capita while richer countries hardly reach 50. In 2005 these four countries received 45% of the total budget of the Structural Funds.[25]

[25] approximately, 14030 out of 3853 million Euro. They count with approximately 17% of the population over the total sample of 15 countries.

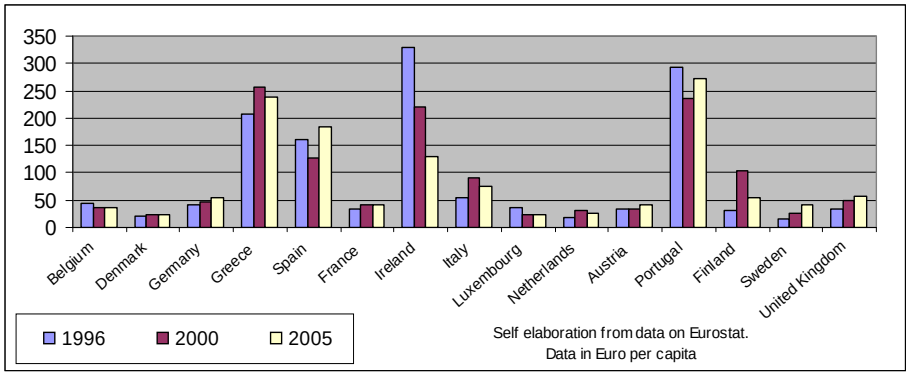

Figure 1: Per capita allocation of SF by member country.

We want to evaluate the relative changes in the pattern of public investment that the Structural Funds may have induced in our sample. In figure [2] we show the evolution of the public expenditure on some keys functional categories for two sub-groups of our sample.[26] On one side we have aggregated data for Greece, Ireland, Portugal and Spain (GIPS), the four main receivers of Structural Funds. In the other group we included the five countries that receive the fewest Funds per capita, namely Denmark, France, Luxembourg, Netherlands and Sweden (DFLNS). The first group includes approximately 68 million people, while the second around 93.

In the period considered, the SPIG group has reduced very slightly the gap of public expenditure per capita in comparison with the DFLNS group. This change has not affected homogeneously all the categories of public expenditure, but has served to reduce the gap in the category "Economic Affairs and Services", which is the one precisely oriented towards reducing the production differences.[27] In the meanwhile, other categories like "Social Security", "Education" and "Health" have maintained almost steady the gap between these two groups of "poor" and "rich " countries[28].

[26] The rest of functional categories of public expenditure not included in the figures are "General public services", "Defence", "Public order and safety", "Environment protection", "Housing and community amenities" and "Recreation, culture and religion". They have been omitted in the analysis since their examination would not include additional information relevant for our purposes.

[27] The gap has been reduced in 365 Euro per capita, while the difference in total public expenditure per capita has decreased 288 Euro.

[28] In particular, the gap for those three categories of expenditure has increased approximately 124, 44 and 8 Euro per capita in the period considered in the figures.

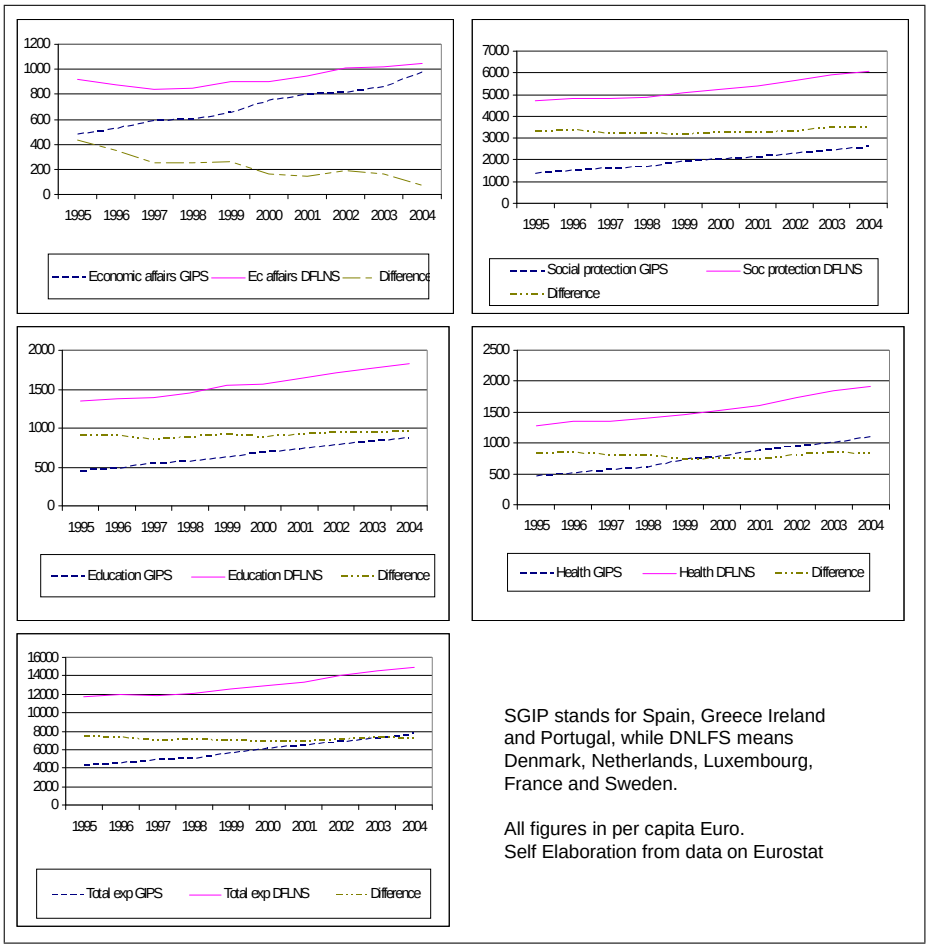

Figure 2: Figure 2: Analysis of the evolution of public expenditure by functional categories and groups of countries.

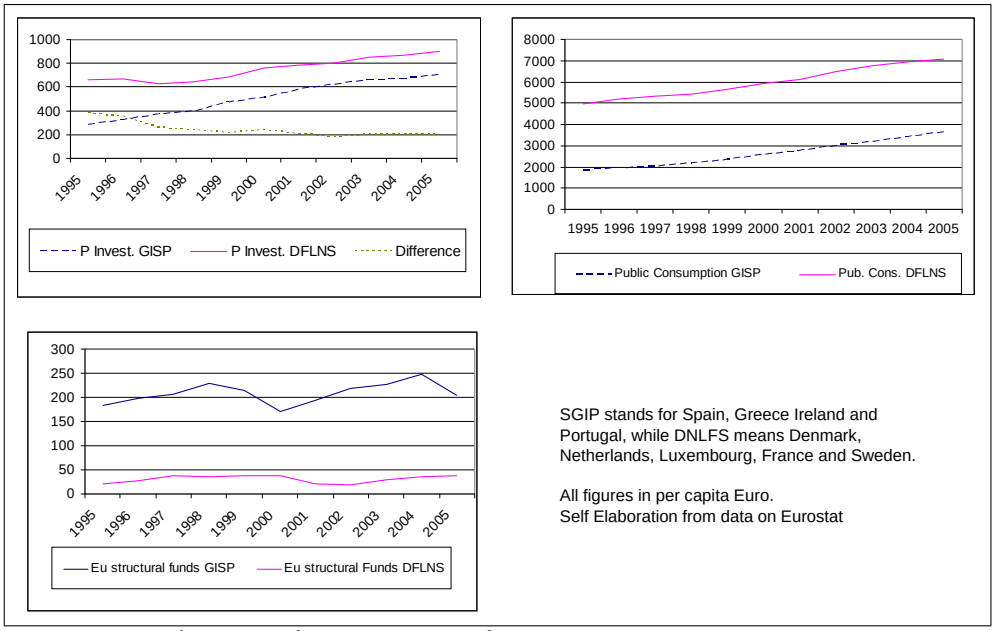

Figure 3: Analysis of the evolution of public expenditure by economic categories and groups of countries.

10 Appendix III

	Obs.	Mean	St. Dev.	Min	Max
Pinv	136	43747.45	86807.24	-194270.6	473657.6
EUSF	136	13347.36	60290.75	-196428.8	230578.3
GDPgr	136	1772733	2222053	-605718.1	1.71e7
PCons	136	273263.6	327047.1	-316868.8	1698880
PrivInv	103	660044.7	943726.6	-188200	6934000
Pop	136	9659.596	36501.66	-159370	167025
Cgcape	136	81234.75	269850.6	-203332	678706

Table A.1: Spanish Regional Data: Summary Statistics.