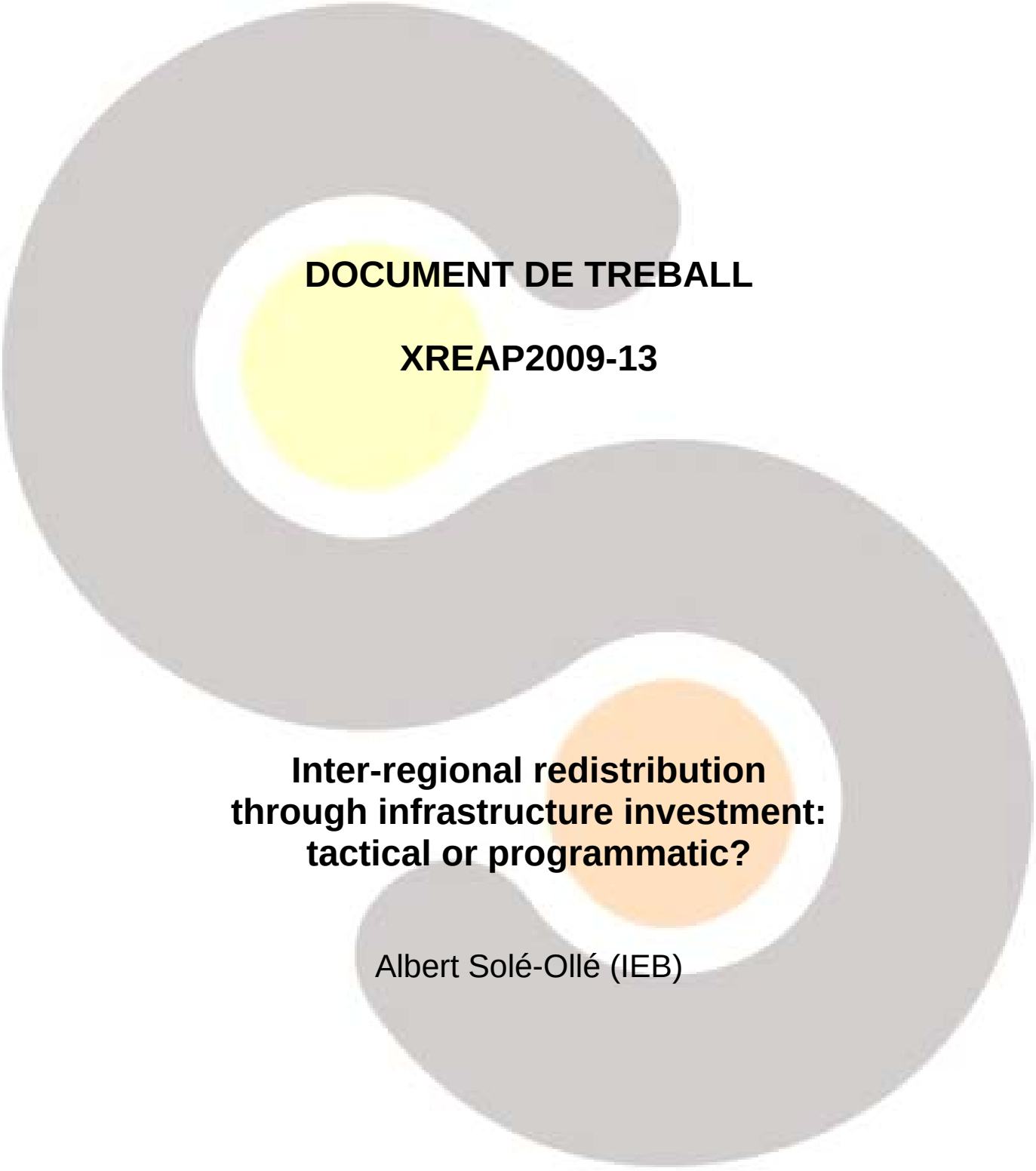

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Inter-regional redistribution through infrastructure investment: tactical or programmatic?

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Inter-regional redistribution through infrastructure investment: tactical or programmatic?

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ABSTRACT: In this paper we analyze the effects of both *tactical* and *programmatic* politics on the inter-regional allocation of infrastructure investment. We use a panel of data for the Spanish electoral districts during the period 1964-2004 to estimate an equation where investment depends both on economic and political variables. The results show that *tactical* politics do matter since, after controlling for economic traits, the districts with more 'Political power' still receive more investment. These districts are those where the incumbents' *Vote margin* of victory/ defeat in the past election is low, where the *Marginal seat price* is low, where there is *Partisan alignment* between the executives at the central and regional layers of government, and where there are *Pivotal regional parties* which are influential in the formation of the central executive. However, the results also show that *programmatic* politics matter, since inter-regional redistribution (measured as the elasticity of investment to per capita income) is shown to increase with the arrival of the *Democracy* and *EU Funds*, with *Left* governments, and to decrease the higher is the correlation between a measure of 'Political power' and per capita income.

JEL Classification: R1; O4

Keyworkds: Infrastructures, Political Economy, Redistribution

1.- Introduction

The inter-regional allocation of infrastructure investment redistributes money from some regions (those that pay taxes) to the others (those where the investment is made). So this infrastructure investment can be qualified as a *redistributive policy*. According to Dixit and Londregan (1996, p.1132-33), the politics of redistributive policies can be classified into two different forms. On the one hand, we have *tactical redistribution*, in which the benefits (building the infrastructure) are paid to a few regions while the costs are shared by all the regions. The implicit assumption here is that the government has full discretion in the allocation of monies to the regions, so the allocation criterion is simply: if I invest in your region (and not in other regions having similar economic traits), it is more probable that I will remain in power?. On the other hand, we have *programmatic redistribution*, in which the government withdraws resources from some regions and distribute them to others (i.e, the regions where the infrastructures are built), with electoral considerations in mind, but subject to some constraints in the selection of beneficiaries, mostly to have a certain income level. Programmatic benefits, therefore, have public good qualities: they redistribute from a given class a beneficiaries to another (from rich to poor regions), but within a class of beneficiaries, particular regions who qualify cannot be excluded.

Most existing studies of the politics of inter-regional allocation of infrastructure investment consider it as merely *tactical*. This is clearly the case of the papers by Knight (2002, 2004), Castells and Solé-Ollé (2005), Cadot *et al*. (2006) and Joanis (2007), for the US, Spain, France and Canada, respectively[1]. This view might have been influenced by the U.S. literature on legislative 'pork barrel' politics (see, e.g., Wright, 1974; Shepsle and Weingast, 1981). There is probably enough accumulated evidence to conclude that this focus on *tactical* politics might be legitimate in the U.S case. However, this approach might be on occasions too narrow, disregarding traits of the allocation of resources which, if not in the U.S., are of crucial importance elsewhere. As Rodden (2009) clearly shows in a recent survey, there are countries (e.g., Canada, Germany, Australia, Spain, or the European Union) were there is a political rhetoric, in some cases enshrined in the constitution, whereby residents of the poorest regions are entitled to the same public services at the same cost as residents of the

[1] This is also the focus of the many other papers analysing the political determinants of intergovernmental grants (see, e.g., Levitt and Snyder, 1995; Case, 2001; Dahlberg and Johansson, 2002; Johansson, 2003).

wealthiest regions. This might take the form of inter-personal transfers, but it might also take the form of subsidies for local public goods as infrastructure in regions with limited tax base. The politics of these transfers are *programmatic*, which means that allocations are to be based on general 'objective' principles, using rules and formulas which limit governmental discretion. It would be interesting to gauge how these principles and rules were adopted, and how do they really influence the final allocation of monies to the regions.

This is specially relevant in the case of infrastructure provision, because it is not entirely clear what 'objective' principles means in this case, since infrastructure investment could be directed either to regions with high project impact, following an *efficiency* criterion, or to regions with low output levels (to foster convergence), thus following an *equity* criterion (Yamano and Ohkawara, 2000; Castells and Solé-Ollé, 2005). The degree of redistribution observed in a given country depends in part on details of the constitutional contract which, as in Spain or the EU, might be the basis for the implementation of a regional cohesion policy (De la Fuente, 2004). However, although constitutions constraint the options that government have regarding inter-regional redistribution, the evolution of the ideological preferences of parties and voters, and the territorial structure of power in a democracy could also determine the final *equity-efficiency* orientation of public policies, in general, and of infrastructure investment, in particular. In this context, rich regions might be in a disadvantaged situation when the territorial structure of electoral power and income do not overlap (e.g., poor regions are over-represented in the legislature), a fact that depends both on the electoral rules set in the constitution and on the temporal evolution of regional income inequalities.

Despite of this interest, however, no papers to our knowledge have really focused on the *programmatic politics* of the inter-regional allocation infrastructure investment. Rodden (2009) tries to explain why intergovernmental transfers are more or less redistributive in a selected sample of nine countries, providing a range of institutional motives. Rodden's paper goes one step beyond the many others that just measure (but do not explain) the inter-territorial redistributive effects of government programs (see, e.g., Bayoumi and Masson, 1994; Bosch *et al*., 2003). The *equity-efficiency* trade-off of regional public investment policies has been analyzed by Yamano and Ohkawara (2000), Castells and Solé-Ollé (2005) and Stephan and Kemmerling (2009), for the cases of Japan, Spain, and several EU countries,

respectively. The last two papers also include a political analysis, but confined to the *tactical* motives, and thus do not try to explain the political reasons of the weight given to *equity* and *efficiency* considerations. In the Spanish case, some papers have previously analysed the rules implicit in the territorial distribution of public investment (Bosch and Espasa, 1999; De la Fuente, 2004). These papers do not account for political factors, which have been discussed by Boix (1998), Vives and De la Fuente (1998), and Castells and Solé-Ollé (2005). This last paper focused of the period 1986-96, enough to bring evidence on the workings of *tactical* politics in Spain but too short to provide any meaningful political change which helps to analyze *programmatic* influences (e.g., the left controlled the government during all sample years).

The purpose of this paper is to study the politics of the inter-regional allocation of infrastructure investment, providing evidence on the relative importance of both *tactical* and *programmatic* motives. With this aim, we have assembled a database for Spain covering the years 1964-2004, with electoral district ('provincia') data on central governments' infrastructure provision and capital stock, and economic and political variables. The main focus of our analysis will be the democratic period 1978-2004, the only for which it has sense to ask about (measurable) political influences. The results of the dictatorship period (1964-1977) will be used for comparison purposes, in order to guess the effects of the arrival of the democracy on the degree of inter-territorial redistribution. The methodology is similar to the one used in Castells and Solé-Ollé (2005). We use pooled data to estimate an equation, where investment depends on economic (i.e., income per capita, capital stock, land area, coastal dummy) and *tactical* political influences (i.e., the incumbent's vote margin of victory/defeat in the last election, the votes needed to win an additional seat in the legislature, the partisan alignment between central and regional executives, and the fact that some regional parties have been pivotal at the central level during some periods). The results suggest that both 'objective' economic variables and *tactical* motives play a role in determining the amount of infrastructure investment allocated to a district. To study *programmatic* politics we pool the full sample to estimate a random coefficients model, allowing the income coefficient (which we interpret as indicative of the *equity-efficiency* trade-off) to include a random term and to interact with variables picking up the main political forces which might influence it. We find that this coefficient decreased with the arrival of the democracy, has been considerably lower

for left governments and for right governments before contested elections, and shows a statistically significant relation with the correlation between per capita income and a measure of 'political power' (i.e., the intensity of redistribution is mitigated as richer regions become more powerful). We therefore conclude that, at least in Spain, both *tactical* and *programmatic* motives matter for the inter-regional allocation of infrastructure investment.

The paper is organised as follows. In the next section we provide an interpretative framework for our analysis. In section three we describe our empirical strategy. In section four we present our data and explain how we have computed the different variables. In section five we present the results obtained. The last section concludes.

2.- Interpretative framework

2.1. Tactical redistribution

Perhaps the best-known theoretical models of tactical redistribution are the ones proposed by Lindbeck and Weibull (1987) and Dixit and Londregan (1998). Both papers assume that the incumbent desires to stay in office, so he distributes the resources between a set of electoral districts with the aim of winning elections. The main empirical prediction of these papers is that monies will flow to *swing* voter districts, which are districts with a high proportion of relatively unattached voters (i.e., voters that are prone to change its vote if there is an economic gain in it). These voters are identified in practice either as the districts where the incumbent won or lose by a thin margin (Case, 2000; Johansson, 2003; Smart and Milligan, 2005) or as the districts with high past vote volatility (Wright, 1974; Strömberg, 2004; Larcinese *et al*., 2006). A different model is developed by Cox and McCubbins (1986), who suggest that politicians are risk averse and –although also wishing to win the elections– prefer to send money to their *core* voters or 'strongholds', because this is a safer investment. Empirically, these 'strongholds' are identified as districts where the incumbent obtained a high share of votes (Johansson, 2003; Levitt and Snyder, 1995). There is some disagreement in the literature regarding which of the two hypotheses is more relevant (Rodden and Wilkinson, 2004), with a few papers finding evidence in favour of the *swing* voter one (Wright, 1974; Dalhberg and Johansson, 2002; Castells and Solé-Ollé, 2005) and others finding evidence in favour of the *core* voter one (Levitt and Snyder, 1995; Larcinese *et al*, 2006; Joanis, 2007). The problems in finding evidence on this might be due to the flawed methods used (Dalhberg and Johansson, 2002; Larcinese *et al*., 2008) but also to the fact that

the two hypotheses could be difficult to disentangle given the similarity of the variables used to measure them (e.g., vote margin vs. vote share). Moreover, both hypotheses might be valid: incumbents may channel more money to thin margin districts than to places in which they won less votes, but also could channel more funds to *core* than to *swing* districts[2].

Other papers identify some additional factors that could also influence the allocation of funds to districts. First, partisan alignment between central and regional governments also makes the funds delivered more productive, because it impedes that the opposition claims some of the credit. This argument might make more sense for intergovernmental grants (Solé-Ollé and Sorribas, 2008; Arulampalam *et al*., 2009), since they are spent by the grantee, but in some instances it can also be applied to direct spending by the Federal government (see, e.g., Larcinese *et al*., 2006). In the case of infrastructure investment, for example, Spanish sub-central governments act as advocates of the regions, identifying the most needed projects and lobbying the central government for its inclusion in the budget. Therefore, alignment increases the productivity of funds delivered either because the incumbent has more knowledge of infrastructure needs (as also happens with *core* voter places) or because voters not only reward the central layer –who is building the infrastructure– but the sub-central one, whose lobbying efforts considers crucial for the granting of the project.

Second, the logic of allocating investment funds to regions might also be affected by electoral rules, which influence the degree of proportionality in the translation of votes to seats. For instance, the literature on legislative malapportionment suggests that more funds will be allocated to over-represented districts, since the vote of their legislators are cheaper to buy. This hypothesis is usually tested by looking at the effects of the vote-seat ratio on the regional allocation of funds (see, e.g., Atlas *et al*., 1995; Hauk and Wacziarg, 2007, and Larcinese *et al*., 2007, for a discussion of the US case). But these effects are not limited to bargaining inside the legislature, and can also affect the behaviour of unified parties competing for winning an election. In this case, lack of proportionality introduces discontinuities in the votes-seats relationship, creating incentives to cater to districts where fewer votes are needed to win an additional seat (or to lose the last seat won). This effect

[2] Moreover, there are some theoretical papers suggesting that the relative bias towards core or swing voters depends on a variety of political and institutional traits that might change from country to country and from an election to another. For example, Dixit and Londregan (1996) suggest that the favours towards *core* voters will be increased as the parties become more effective in delivering benefits to its own support group; Grossman and Helpman (2008) say these incentives depend on the degree of party discipline, and Besley (2007) suggest they are influenced by electoral competition.

clearly operates in winner-takes-all systems (see, e.g., Snyder, 1989; Stromberg, 2008) but is also relevant in electoral systems with other rules that depart from perfect proportionality (e.g., Saint-League or d'Hondt, as in the Spanish case). In this case, the relevant variable to use is not the vote-seat ratio, but the exact calculation of the number of votes needed to win an additional seat (see, e.g., Castells and Solé-Ollé, 2005, and section 3 below).

Finally, the formation of legislative coalitions opens the door to the influence of pivotal regions, which are those whose representatives have a higher probability of determining the outcome of the election. Clearly, in winner-takes-all systems, size (i.e., absolute number of representatives) influence the probability of being pivotal, as Stromberg (2005) demonstrates in the case of the US Electoral College. In parliamentary systems with two main parties, as is the case of Spain, this opens the door for the influence of pivotal parties which are regionally based. Of course, this effect appears when none of the two main parties has a clear majority of seats. There is some evidence that this happened in Spain during the 90's (Castells and Solé-Ollé, 2005).

A model of tactical redistribution. In the case of infrastructure investment in Spain, most of these empirical predictions can be accounted for using a simple framework similar to the ones proposed by Strömberg (2004) and Castells and Solé-Ollé (2005, p.1202). Suppose for instance that the incumbent party at the central government allocates a fixed amount of investment[3] across J electoral districts with the aim of maximizing the number of representatives obtained in a legislative election. The incumbents' problem can thus be written as:

$$\underset{\{i_1,...,i_J\}}{\text{Max}} \quad e=\sum_j e_j \qquad \text{s.t.:} \quad \sum_j i_j n_j = \bar{i} \tag{1}$$

Where $\bar{i}$ is the (exogenous) amount of resources available, i_j is the per capita investment allocated to region j, and n_j and e_j are the population and the number of representatives of that region j. The FOC of this problem are

$$\left(\frac{\partial e_j}{\partial v_j}\frac{\partial v_j}{\partial u_j}\right)\left(\frac{\partial u_j}{\partial y_j}\frac{\partial y_j}{\partial c_j}\frac{\partial c_j}{\partial i_j}\right)-\lambda n_j = 0 \qquad \forall j \tag{2}$$

[3] This fixed budget assumption is usual in distributive politics models (see, e.g., Cox and MacCubbins, 1986, and Lindbeck and Weibull, 1987) and is reasonable in our case given actual investment budgeting practices in Spain (see Castells and Solé-Ollé, 2005).

Where $v_j=n_jF_j(\theta_j u_j)$ are the number of votes obtained in j, F_j being an incumbent's vote distribution function with density f_j; u_j is the utility of a resident in j, depending on per capita resident income y_j, which is in turn influenced by the per resident infrastructure capital stock of the region, c_j; θ_j is an indicator of the productivity of the efforts of the incumbent party in district j, which might be higher if the incumbent has better knowledge of districts' infrastructure demand (recall that we said that this is to be expected to happen in strongholds) or if the voters are better able to attribute the responsibility for infrastructure delivery to the incumbents' party (recall that we argued that this happens when there is partisan alignment between the central and sub-central governments); and λ is the Lagrange multiplier, which accounts for the overall availability of investment funds. Expression (2) says that infrastructure should be allocated to equalize the marginal impact on representatives across regions. This marginal impact is the product of two terms: the effect of a change in utility on representatives and the effect of investment on utility.

Now, we assume for convenience that F_j is a uniform distribution with support $|-\eta_j,\eta_j|$, and we use very simple functions for utility and production:

$$u_j = k + \frac{y_j^{1+\varepsilon}}{1+\varepsilon} \qquad \text{and} \qquad y_j = a_j c_j^{\alpha_j} \tag{3}$$

Where $\varepsilon \leq 0$ is a parameter which affects the concavity of the utility function and allows us to take into account the diminishing marginal utility of income, a_j is a district-specific productivity shifter, and $\alpha_j \geq 0$ is the coefficient of infrastructure capital in the production function, which varies from district to district. Using all that information, knowing from the permanent inventory identity that $\partial c_j / \partial i_j = 1$, and defining $\mu_j = \partial e_j / \partial v_j$, we can rewrite the FOC as

$$\mu_j \theta_j \eta_j \alpha_j \frac{y_j^{1+\varepsilon}}{c_j} - \lambda = 0 \qquad \forall j \tag{4}$$

Now, after taking logs and rearranging, we can provide the following expression for the amount of infrastructure capital desired by the incumbent for district j

$$\ln c_j = \beta_j + \sigma \ln y_j + \ln \psi_j \tag{5}$$

Where $\beta_j = \ln \alpha_j - \ln \lambda$, $\sigma = 1 + \varepsilon$ and $\ln\psi_j = \ln \mu_j + \ln \theta_j + \ln \eta_j$. So, desired per capita infrastructure capital for district j increases with per capita income –but less than

proportionally if ε<0– and with 'political power' ψ_j, which in turn is higher: (i) the lower the votes needed to win an additional representative (μ_j), (ii) the higher the productivity of funds channelled by the incumbent to that district (θ_j), which will be higher in strongholds and/or when there is partisan alignment with the sub-national government, and (iii) the higher the marginal voter density (η_j), which measures the share of *swing* voters or voters that are not strongly ideological. The only apparently relevant political factor that this framework is not able to account for in the Spanish case is the effect of pivotal regional parties in periods where the central government is in minority. Nevertheless, we will also consider this effect in the empirical analysis[4].

2.2. Programmatic redistribution

It is perhaps unfair to qualify all infrastructure investment as a result of tactical redistribution. When deciding the amount of infrastructure investment to carry out in a specific region, the government takes into account its political reality but also some 'objective' economic criteria. Moreover, the government uses to be constrained to some extent by the 'objective' criteria set by the Constitution and other laws difficult to amend. In any case, inside the margin set by these constraints, the government will be forced to justify in front of both party followers and the general electorate which are the concrete criteria used. So, both the preferences of the voters and the ideology of the party will influence the implementation of these 'objective criteria'. The important idea to retain here is that we are in the realm of *programmatic redistribution*, so redistribution could not operate without some sort of criteria.

But, which are the possible criteria to use? On the one side, the government might consider to invest more where the are more users of the infrastructure (i.e., cars, trucks or miles driven, in the case of roads), which basically means investing in rich regions, or where there is a lower stock of capital (i.e, if the region is 'rich' but already has the appropriate road stock, it might not deserve more road investment). This kind of policy it is said to be 'efficiency-oriented'. However, either a constitutional mandate or the ideology of the government might force the use of investment as an instrument of regional policy, the allocation going towards less developed regions. In this case, we will say that the investment policy is

[4] The above interpretative framework focuses on electoral politics, while it could be argued that Spanish politics are also influenced by post-electoral bargaining in the legislature. We do not deny this, but these forces have not been working during all the terms-of-office we analyse and its influence is less important quantitatively than the one of electoral forces, as results below will show.

equity-oriented. According to Castells and Solé-Ollé (2005), an efficiency-based rule would allocate infrastructure investment in proportion to regional income (i.e., GDP), and a rule which gives some weight to equity will allocate investment less than proportionally to income (and could even give more monies to poor regions). So, the elasticity of investment to income will inform us about the *efficiency-equity trade-off* (or taste for inter-regional redistribution) of a given government. Below we will provide a simple framework which will illustrate these ideas more precisely.

This taste for redistribution will differ from country to country, depending on values and constitutional provisions (Wibbels, 2005). Democratic constitutions can be considered conceptually as a contract in which regions decide over future redistribution under uncertainty about future incomes (Person and Tabellini, 1996; Bodenstein and Ursprung, 2005). That contract will influence redistribution both through the inclusion of some principles and mandates, but also trough the electoral rules that will provide poor people/regions with more influence than in an undemocratic setting (Meltzer and Richard, 1981; Boix, 2003; Rodden, 2009). Constitutions can also be considered as a contract between different regions that bargain in order to distribute the costs and benefits of the union (Weber and Le Breton, 2002; Spolaore, 2009). In the case of Spain, the 1978 Constitution directly calls for policies to enforce territorial equity (De la Fuente, 2004). Moreover, EU funds can be considered also a result of the constitutional arrangements of the country, in the sense that they are imposed from above and decided before the operation of national partisan politics. Some of these funds have a strong equity orientation (e.g., European Regional Development Fund, ERDF, Objective 1 regions), with highly redistributive rules constraining the internal allocation of funds between regions. From now on, we will use the term 'constitutional' to refer to this first set of influences on the taste for inter-regional redistribution.

In any case, even after these institutional constraints, there will be room for the upcoming governments to try to influence the degree of redistribution. This means that in *programmatic redistribution* models, the government does not directly choose the money send to each district, but is constrained to act 'as if' he is choosing a taste-for-redistribution parameter (i.e., in the above discussion, the elasticity of investment to income). There are several ways to address this problem. First, the *median voter* theory of redistribution (Meltzer and Richard, 1981) says that the amount of redistribution will be the one preferred by the

median voter (here the median region) and thus will increase in the distance between median regional income and average regional income. Second, *partisan* theories of redistribution (see, e.g., Alesina and Rosenthal, 1995) suggest that if left and right parties have different views regarding inter-territorial redistribution –and they cannot credibly commit to provide regional policies that the voters know are different to its preferred ones– they will probably implement different policies once in office. Third, in the *probabilistic voting* model of redistribution (e.g., Persson and Tabellini, 2000, ch. 6) no single voter (region, in our case) has the full power to determine the outcome (as in the median voter case) but the resulting taste for redistribution is a weighted sum of the tastes of the different income groups, the weights being the electoral power of each group. As in the tactical models introduced above, the regions with more electoral power are the *swing* regions. So these models say that redistribution will be higher if low income regions are *swing* regions. Empirically, the theory can be tested by focusing on the effect of the correlation between regional income and the incumbent's vote margin of victory/defeat. Other variables related with regional 'political power' (e.g., marginal seat price, alignment or pivotal regions) can also be included in the power index, that can be then used to compute that correlation. In the rest of the paper, we will use the term 'electoral' to refer to this second set of influences on the taste for inter-regional redistribution.

A model of '*constitutional*' *programmatic redistribution.* Following the approach of Berhman and Craig (1987) and Castells and Solé-Ollé (2005), suppose that the incumbent allocates investment across districts to maximize the following social welfare function

$$\underset{\{i_1,\ldots,i_J\}}{\text{Max}}\ w=\left(\sum_j n_j\, u(y_j)^{\phi(\varsigma)}\right)^{1-\phi(\varsigma)} \quad \text{s.t.:} \quad \sum_j i_j n_j = \bar{i} \tag{6}$$

Where n_j is the population of the *j* district. This is a CES social welfare function that allows varying degrees of relative regional inequality aversion. The ϕ parameter quantifies the aversion to regional output inequality, and its range of variation goes from $-\infty$ to one. As ϕ becomes more negative, inequality aversion increases. When $\phi \to -\infty$, the function approaches pure equity. In the intermediate Cobb-Douglas case ϕ is zero. And if ϕ is equal to one, then the government is exclusively worried about efficiency. In this case, *w* equals aggregate country's utility, which reduces to aggregate output when using the utility function in (3) with ε=0. Note that we assume that this parameter depends on a vector of variables (ς)

which pick up what we have termed as 'constitutional' influences on the degree of aversion to regional inequality.

The FOC of problem (6) are

$$\left(\frac{\partial w_j}{\partial u_j}\right)\left(\frac{\partial u_j}{\partial y_j}\frac{\partial y_j}{\partial c_j}\frac{\partial c_j}{\partial i_j}\right)-\lambda=0 \qquad \forall j \tag{7}$$

Using the same functional forms than in the previous section, we are able provide this expression for the amount of infrastructure capital desired by the incumbent for district *j*

$$\ln c_j = \beta_j + \phi(\varsigma)\sigma \ \ln y_j \tag{8}$$

This expression is similar to (5). The differences are the exclusion from (8) of the 'political power' variables and the fact that now the output coefficient is multiplied by ϕ. This means that –if we consider the σ parameter as basically constant across time and space– variations of the output elasticity of the capital stock across samples will be informative of differences in the degree of aversion to inequality, or 'equity-efficiency' trade-off, exemplified by the ϕ parameter. For example, one could search for explanations for this 'equity-efficiency' trade-off by allowing this parameter to be different in periods where different constitutional constraints apply.

A model of '*electoral*' *programmatic redistribution.* Let's suppose now that 'constitutional' norms do not totally fix the 'taste for redistribution' parameter, but only force the government to stick to some 'objective' criteria, defined from a formula which relates per capita investment and (relative) per capita income. To compare this scenario with the ones introduced above, we use the following simplified formulation

$$i_j = \pi\, y_j^{\ \phi} \tag{9}$$

Where π is a parameter which depends on the overall amount of investment funds available (which we consider, as before, fixed) and ϕ is the 'taste-for-redistribution' parameter, which now is the decision variable. Taking into account the production function in (3), after some calculations, the effect of ϕ on y_j can be written as

$$\frac{\partial y_j}{\partial \phi}=\left(\frac{\partial y_j}{\partial c_j}\frac{\partial c_j}{\partial i_j}\frac{\partial i_j}{\partial \phi}\right)=\pi\alpha_j\frac{y_j^{\phi+1}}{c_j}\ln y_j \tag{12a}$$

If we assume, to simplify, equal productivity parameters ($\alpha_j = \alpha$) and instantaneous depreciation (meaning that $c_j = i_j$), expression (12) reduces to

$$\frac{\partial y_j}{\partial \phi} = \pi\alpha\, y_j \ln y_j \tag{12b}$$

Expression (12b) indicates that an increase in the efficiency orientation of public investment benefits rich regions. The incumbents' problem can now be stated as

$$\underset{\{\phi\}}{\text{Max}} \quad e = \sum_j e_j \qquad \text{s.t.:} \quad i_j = \pi\, y_j^{\phi} \quad \text{and} \quad \sum_j i_j n_j = \bar{i} \tag{13}$$

The FOC is now

$$\sum_j \left(\frac{\partial e_j}{\partial v_j}\frac{\partial v_j}{\partial u_j}\right)\left(\frac{\partial u_j}{\partial y_j}\frac{\partial y_j}{\partial \phi}\right) = \lambda \frac{\partial\left(\sum_j i_j n_j\right)}{\partial \phi} \tag{14}$$

Taking (12b) into account, setting $\varepsilon = 0$, and defining the political weights Ψ_j as in previous sections, the FOC in (14) can now be expressed as

$$\sum_j \Psi_j n_j y_j \ln y_j = \lambda^* \sum_j \left(\frac{1}{y_j^{1-\phi}}\right) n_j y_j \ln y_j \tag{15}$$

Where $\lambda^* = \lambda\pi/\alpha$ is a constant. Expression (15) says that, in equilibrium, ϕ should be set in order to ensure that the resulting weights applied to the different income classes (i.e., $1/y_j^{1-\phi}$) matches the income pattern of political weights (i.e, the correlation between Ψ_j and y_j). Note that as ϕ goes to zero the weights approach inverse income (i.e., $1/y_j^{1-\phi}$) while when ϕ =1 all the income classes receive the same unit weight. So, if rich regions become more powerful (i.e., the correlation between Ψ_j and y_j increases) ϕ should rise in order to make the weights less correlated with inverse income. Hence, this simple model predicts that the elasticity of infrastructure capital to income (the ϕ parameter) should be higher in samples (i.e., countries, time periods) where the positive (negative) correlation between 'political power' and income is higher (lower). This argument suggest an empirical relationship like

$$\ln c_j = \beta_j + \phi(\rho)\sigma\ \ln y_j \tag{16}$$

Where $\rho = corr(\psi_j, y_j)$ is the correlation between 'political power' and per capita regional income. In the empirical analysis we will test this hypothesis along with others that have been identified above (i.e., median voter and partisanship).

3. Empirical design.

General specification. Our purpose is to investigate which are the most relevant factors that have influenced the inter-regional allocation of public investment in Spain during the period 1964-2004, both from the *tactical* and *programmatic* perspectives. Since we do not know in practice which of the above-presented models of inter-regional redistribution is more appropriate, we assume that the desired capital stock for district *j* is just a sum of the amounts determined considering either *tactical* or *programmatic* motives. Adding a time-subscript to the variables and also allowing ϕ varying in the time dimension, we have the following random-effects model

$$\ln c_{jt} = \beta_{jt} + \phi_t \ln y_{jt} + \alpha_P z_{jP} + \upsilon_P x_j \tag{15a}$$

$$\beta_{jt} = \beta_j + \beta_t + \xi_{jt} \tag{15b}$$

$$\phi_t = \phi_0 + \phi_1 \varsigma_t + \phi_2 \rho_t + \zeta_t \tag{15c}$$

Where we have set $\sigma = 1$ and $\ln \psi_{jt} \cong \alpha_P z_{jP}$. The variables included in z_{jP} capture the different tactical influences discussed above, which vary by term-of-office (*P*) but remain (in most of the cases, see section 3) constant for the years of a given term, and whose effect is allowed (at least in some specifications) to vary from one term to the other. The parameter β_{jt} is an intercept which includes district (β_j) and time (β_t) effects and a random error term (ξ_{jt}) with the usual properties. The time effects will be considered fixed, while the district ones will be treated as random, after using the Hausman test to check the appropriateness of this assumption. This fact allows us to include in the equation a set of time-invariant variables (x_j) to pick up other economic and geographical influences on infrastructure investment, whose effect is also allowed (in some specifications) to vary from one term to the other. The 'taste-for-redistribution' parameter ϕ_t is also treated as a random coefficient, depending on variables picking up the 'constitutional' (ς_t) and 'electoral' (ρ_t) explanations of the degree of inter-regional redistribution, also including a random time effect (ζ_t).

In order to allow for the sluggish adjustment of the capital stock to both economic and political shocks, we model the dynamics of investment decisions with an autoregressive distributed lags model of order one, ADL(1,1), which we are able to express in its Vector Error Correction (VEC) form as

$$\Delta \ln c_{jt} = -(1-\delta_P)(c_{jt-1} - \phi_t \ln y_{jt-1}) + \alpha_P' z_{jP} + \upsilon_P' x_j + \gamma_0 \Delta y_{jt} + \gamma_1 \Delta y_{jt-1} + \gamma_2 \Delta \ln c_{jt-1} + \beta_{jt}' \quad (16)$$

Where δ_P is the sluggishness parameter, and contemporaneous and lagged income increases and a lagged capital stock increase have been added to the equation. Using the permanent inventory equation, this expression can be rewritten in terms of investment effort ($i_{jt}=I_{jt}/C_{jt-1}$), computed as the ratio of investment and lagged capital stock

$$i_{jt} = -(1-\delta_P)(c_{jt-1} - \phi_t \ln y_{jt-1}) + \alpha_P' z_{jP} + \upsilon_P' x_j + \gamma_0 \Delta y_{jt} + \gamma_1 \Delta y_{jt-1} + \gamma_2 i_{jt-1} + \gamma_3 \Delta n_{jt} + \gamma_4 \Delta n_{jt-1} + \beta_{j,t}' \quad (17)$$

Where contemporaneous and lagged population increases have been added to the equation[5]. Stated in this way, the equation says that although the incumbent may prefer a given capital stock for a region, given its income and economic traits, in practice investment will evolve slowly towards this preferred capital stock and, moreover, that there might be short-term shocks temporarily affecting investment.

Empirical strategy. We will proceed by steps. First, in order to provide evidence on the political variables which are most appropriate to account for *tactical* redistribution effects, we begin by estimating equation (17) with Spanish electoral district data for the entire democratic period (1978-2004). In this analysis, we keep the coefficients constant over time (i.e., $\delta_P = \delta$, $\phi_t = \phi$, $\alpha_P' = \alpha'$ and $\upsilon_P' = \upsilon'$). Second, in order to gauge the stability of these *tactical* variables over time we re-estimate equation (17) for several sub-periods. The results obtained will allow us to assess, for the different periods evaluated, the explanatory capacity of the political factors associated with *tactical redistribution* theories (included in the *z* vector), and to compute a summary 'political power' index to be used afterwards in the analysis of *programmatic* redistribution. These results will also allow us to provide a first assessment of the *equity-efficiency trade-off* implicit in the interregional allocation of infrastructure investment, and embedded in the ϕ parameter (see Castells and Solé-Ollé, 2005). The value of this parameter in the different periods will allow us to guess which political factors associated with *programmatic redistribution* theories could explain the

[5] The permanent inventory equation says that $C_{jt}=(1-\rho)C_{jt-1}+I_{jt}$, where ρ is the depreciation rate; by rearranging this expression and after taking logs we find that $\Delta \ln C_{jt}=\ln(1+I_{jt}/C_{jt-1}-\rho)$; the left hand side can be approximated by $I_{jt}/C_{jt-1}-\rho$ when this expression approaches zero. Finally, to arrive at (17), note that $\Delta \ln c_{jt}=\Delta \ln C_{jt} - \Delta \ln n_{jt}$.

intensity of inter-regional redistribution (see section 2). Third, in order to provide a more formal test to these theories, we will re-estimate the model with data for the full period (1964-2004), including now both the democratic years (1978-2004) and the dictatorship period (1964-1977), treating now the ϕ parameter as random and making it depend on a number of variables that pick up both the 'constitutional' and the 'electoral' determinants of programmatic redistribution.

Econometrics. There are several econometric concerns in estimating this equation. First, one should check that the random-effects model is to be preferred both to OLS and to fixed effects. So, we estimated these three specifications and used the Breusch-Pagan and Hausman tests to select the best model, which at the end turned to be the random-effects one, which was estimated by GLS. Second, while our dependent variable is measured annually, most of the right-hand side political variables are constant within a term-of-office, causing a well-known grouped variables problem[6]. Also, one of the political variables (i.e., partisan alignment, see section 3 below) is the same for all the districts belonging to the jurisdiction of a regional government, causing a similar problem. To avoid providing artificially low standard errors we include two additional random effects in (15b), one varying by district and term-of-office (i.e., β_{jP}) and the other by year and regional government (i.e., β_{tR})[7,8].

Third, the contemporaneous increase of income (i.e., Δy_{jt}) could be endogenous, since the capital stock enters simultaneously as an argument in the production function and, even most important, because investment might have a direct multiplier effect on current regional economic activity. To account for this possibility, the model has been estimated by Instrumental Variables, using as instruments of $\Delta y_{j,t}$ the five years lagged levels of per capita income and of the stock of human capital, computed as the average number of schooling years of the labour force (data coming from IVIE, 2007). Human capital can be plausibly considered as exogenous and had a substantial impact on regional growth in Spain during the period analyzed (Vives and De La Fuente, 1998; De La Fuente, 2002). These

[6] See Smart and Milligan (2005) and Larcinese *et al*. (2008) for a discussion of this problem in a similar context.
[7] Note that geographical variables are constant though the entire sample. In this case, however, the inclusion of a random district effect β_j is enough to ensure efficiency.
[8] This approach assumes common covariance structure across groups. However, the more flexible alternative of computing standard errors using the cluster-correlated Huber-White covariance matrix estimator has been shown to perform rather poorly when the number of clusters is small (see, e.g., Wooldridge, 2004, and Dufflo *et al*., 2004).

instruments were indeed valid, since the Sargan test showed that they were not correlated with the error term and the first-stage F-statistic was high. After instrumenting (see results below), the effect of $\Delta y_{j,t}$ was positive but small and, in any case, not significant at a conventional level; more importantly, the estimated long-run income coefficient ϕ did not change much. For this reason we did not include $\Delta y_{j,t}$ in the subsequently estimated equations, obtaining thus a null contemporaneous impact effect of income on investment. These results suggest that it is difficult for the government to instantaneously adapt the allocation of investment to a region after a change in its characteristics (see also Castells and Solé-Ollé, 2005). This has an intuitive appeal because governments' investment decisions are most likely to be based on the most recent data available from each region. These data generally will be for previous years, given that investment projects are included in the budget during its formulation.

Fourth, one should check for the appropriateness of the lag structure in order to ensure that the error term is white noise. We estimated versions of the model with two and three lags of income, population and investment. The addition of these lags did not change much the results and we decided to keep the model simple for parsimony, since as we have explained, the model will be estimated both for the full period and for four-year periods, considerably reducing the number of observations available.

4.- Data and variables

Sample. In order to get a complete picture of the motives behind interregional redistribution in Spain, we first estimate equation (17) with data on the entire democratic period (i.e., years 1978 to 2004). The year 2004 is the last one for which we have been able to collect the data on investment and capital stock at the electoral district level (i.e., 'provincia'). We will use also the years 1964 to 1977, which belong to the pre-democratic period (i.e., Franco's dictatorship). Our aim when including this period is to allow us to analyze the effect the democratic constitution over inter-territorial redistribution. We will divide the democratic period in 8 sub-periods, corresponding to the terms of office of each of the Spanish governments since 1978. The first two sub-periods correspond to the right UCD governments (Unión de Centro Democrático, 1978-79 & 1980-82), the following four sub-periods are those of the left PSOE governments (Partido Socialista Obrero Español, 1983-86, 1987-89,

1990-93 & 1994-96) and the last two to the two right PP governments (Partido Popular, 1997-2000 & 2001-04).

Dependent variable. Our data on infrastructure investment includes only economic infrastructures, which are the ones deemed to have stronger effects on growth (Montolio and Solé-Ollé, 2009). The data comes from a database elaborated by the Fundacion BBVA (*El stock de capital en España y su distribución territorial* (1964-2002)). This database provides information at the provincial level on investment made by the Spanish central government in roads, railroads, ports, airports and water projects, which are the categories that we include in our definition of infrastructure. Unfortunately, this database only provides information till 1998. The new methodology used since then by the Fundación BBVA (*El stock de capital en España y su distribución territorial* (1964-2005). *Nueva metodología*) provides information on investment till 2004 but not by layer of government. In the case of road investment, the statistics elaborated by the Ministerio de Fomento (*Anuario Estadístico*) allow us to know the investment made by the central government in each province, so the database can be easily extended. For the remaining categories, we used two different procedures to extend the series of central infrastructure investment to the period 1999-2004. First, we distributed the investment made by the central government in each Autonomous Community (known from the statistics of the Ministerio de Fomento) between its provinces using the provincial investment share in the period 1995-98. Second, we also calculated for each province the average share of the central government in non-road investment for the period 1995-98, and multiplied investment in these categories in the following years by this percentage. The correlation between the two measures of central government's investment obtained using these procedures is very high (0.987) and the results obtained are not affected by the concrete series we choose, so we decided to use an average of the two. Moreover, repeating our analysis using only road investment by the central government (here there are no imputations) does not alter the conclusions reached. Finally, performing the analysis with overall investment made by the central + regional governments (this information is available for the full period) also provided the same qualitative results (as also happened in the study by Castells and Solé-Ollé, 2005).

(Insert Figure 1)

Figure 1 shows a time plot of the investment effort made by the Central + Regional governments and only by the Central government. The infrastructure investment effort was quite low during the dictatorship, increased with the arrival of the democracy, and experienced an abrupt increase with the arrival of the left government in 1982 and again in the second half of the 1980's, with the reception of EU funds. Then, infrastructure investment decreased during the 1990's, coinciding with the economic crises at the beginning of the decade and with the pre-Maastricht budget stabilization policy. Finally, infrastructure investment decreased again since 2000, due to the stringent deficit policy of the new right government. We also plot the evolution of the share of infrastructure investment funded by redistributive EU funds, where we mean by redistributive those funds that are rule-earmarked to poor regions and have been used to fund infrastructure projects; as a practical solution, we measure these funds by the monies coming from European Regional Development Funds (ERDF) Objective 1 and which have been used to fund these types of projects. The source of this data is the reports published yearly by the Ministerio de Economía y Hacienda. Note that the share of this infrastructure funded by the EU reached a peak of 19% in 1997 and decreased then to a 9% in 2004. This means that although these funds can not be reallocated from poor to rich regions, its limited share will probably allow to compensate rich regions by other means (of course, only when the government considers desirable to do it). The final plot included in Figure 1 is the ratio of *Redistributive EU Funds* to overall EU funds, which decreased since the very beginning, first because Objective 1 Funds represented a higher share of ERDF's resources during the 1980's than afterwards, and second as a result of the creation of the Cohesion Fund in 1993, which resources are not earmarked to infrastructure projects in poor regions. We will recover this evidence in section 5 to interpret the evolution of the redistributive intensity of infrastructure investment in Spain.

Economic variables. The infrastructure *capital stock* used to compute the investment effort and also as a control variable, also comes from the Fundación BBVA database and is measured at 2000 prices. In this case the variable refers to the overall capital stock, and the information has never been provided by layer of government. The coefficient of this variable can be interpreted as the share of the adjustment towards the desired capital stock which is implemented in a given year (see also Castells and Solé-Ollé, 2005). This parameter is

crucial to estimate the long-run impact of income per capita over investment (calculated as the ratio between the income and the capital stock coefficients).

The other economic control variables included are: *income* per capita, *land area* per capita, a *coast* dummy, an *island* dummy, a variables measuring climate (% *days freezing*) and terrain ruggedness (% *land over* 1,000 meters of altitude), and an indicator of the level of *responsibilities* in the provision of infrastructure retained by the central government in a given year. Income per capita is the GDP per capita at market prices, measured at 2000 prices. The information comes from an old publication published yearly by BBV (*La renta nacional de España y su distribución provincial*, several years), and from the Spanish Regional Accounts published by the Instituto Nacional de Estadística (www.ine.es). The geographical variables have been taken form the *Anuario Estadístico de España*, also published yearly by INE. The indicator of the level of responsibilities have been computed after observing the concrete year when one regional government (Comunidad Autónoma, AC) has received an specific responsibility; before any responsibility has been transferred, the indicator for the provinces belonging to that AC is 1, and after the transfer is 1 minus Spanish investment in the transferred category over total Spanish infrastructure investment. We have to say now that the performance of most of these variables is rather poor; only income, the land area and the coastal dummy are statistically significant and show consistent results in most of the cases. Even the responsibility index is not statistically significant at conventional levels; this might be due to the fact that these responsibilities were transferred at similar moments to the different AC's, with the result that the influence vanished once time effects have been included in the equation. So, our preferred specification will include only the three main economic controls.

Political variables. We include four political control variables: *Vote margin*, *Marginal seat price*, *Partisan alignment* and *Pivotal regional party.* The information used to construct these variables comes from the website of the Ministerio del Interior (www.elecciones.mir.es). The variable *Vote margin* of victory/defeat in the last election aims to capture the influence of voters that are not particularly attached to the incumbent or to the alternative party/parties and, therefore, are more prone to change its vote in response to an economic premium. This variable can be theoretically justified by assuming that the vote density function (i.e., f_j in section 2) is single-peaked and symmetric. In this case, a higher vote

margin (i.e., abs|*vote share* – 50%| always implies a lower density of votes (Case, 2000; Johanssen, 2003). Intuitively, the more distant the incumbent is from the 50% of the vote, the more difficult is for him to gain (or lose) additional votes. There are, however, some practical problems in implementing this idea. First, this theoretical prediction is based upon a model of bipartisan competition, while in Spain there are many parties concurring at the election in each district. Second, although there is some evidence for other countries that the vote density function is 'approximately' single-peaked it also seems to be asymmetric (see the results in Dalhberg and Johansson, 2004, for Sweden), meaning that the density might start to fall either below or above a 50% vote share. Third, as we explained in section 2, in practice the effects of the variable *Vote margin* can be confounded with those of *vote share*, which is the way scholars use to measure the alternative hypothesis that says that resources are allocated to the incumbent's strongholds. All this suggests that the functional relationship between the vote share and investment should be empirically estimated, without imposing too much structure on the data. With this purpose we estimate a non-parametric *median spline* between the incumbent vote share in the last election and the residual of equation (17) as estimated including only the economic covariates. The results for the full sample and for various sub-periods (see Figure 2) show in all the cases an inverted U-shape, with a maximum amount of investment received at a point between 43% and 46% of the vote, with an average of 45% for the full period. The relationship is quite symmetric in the case of the first right governments (UCD between 1978 and 1982) and for the full democratic sample. The shapes for the leftist PSOE and for the rightist PP also follow this pattern but are more asymmetrical: that of the PSOE is flatter on the left side and that of the PP is flatter on the right side. In any case, these relationships suggest that the *swing* voter theory has some appeal in Spain[9] and that a *Vote margin* of victory/defeat computed as abs|*incumbents' vote share* – 45%| can be an appropriate variable to use[10].

[9] This does not mean, however, that we pretend that the core voter theory can be totally dismissed in the Spanish case. For instance, the shape obtained for the socialist party (i.e., PSOE), showing a flatter slope at a high vote share, suggests that this party ranks districts in the following order: (i) Swing districts (let's say from 30% to 50% of the vote), (ii) Incumbent's strongholds (more than 50% of the vote), and (iii) Opposition strongholds (less than 30% of the vote). Disentangling in which circumstances (parties and elections) each type of behaviour is more relevant is outside the scope of this paper and deserves additional research efforts.

[10] We have also tried other estimations: (i) using a specific peak for each sub-period, (ii) allowing for asymmetric slopes at each side of the peak, and (iii) estimating a flexible spline function. In all the cases the results are qualitatively similar, so we have decided not to include them here. We have also estimated the median spline using the investment effort variable directly and using adding more controls to the first-stage regression; the results are similar to the ones presented here.

(Insert Figure 2)

The second political variable included –*Marginal seat price*– uses the results obtained in the last election to compute exactly how many votes more/less are needed to win/lose an additional seat in the central legislature[11]. We follow Castells and Solé-Ollé (2005), who use a simple algorithm of the d'Hondt rule (which is the one used in Spain to translate votes to seats) to perform this calculus. The third political variable used, *Partisan alignment*, is a dummy indicating if the regional government is or not aligned with the central one. We consider the two governments to be *aligned* if they are controlled by the same party (either as a majority party or as the leader of a coalition). This is the variable that had a better performance in previous analysis of the effect of alignment in Spain (Solé-Ollé and Sorribas, 2008). The last political variable is a dummy, *Regional pivotal party*. In practice, this dummy takes the value one for the provinces in Catalunya, País Vasco and Canary Islands, during the two minority governments of the 90's (PSOE during 1993-96 and PP during 1997-2000). Previous analyses have shown that this variable is relevant (Castells and Solé-Ollé, 2005).

5. Results

Tactical redistribution. The results of the estimation of equation 1 for the full democratic period are presented in Table 1. Columns (1) and (2) show the estimation of the Random and Fixed effects models, respectively, including only those variables that have both cross-section and time series variation. The B-P test (Breusch-Pagan, 1980) rejects the poolability of the data, indicating the need to account for random effects in the model in order to ensure efficiency. Note also that the coefficients of the Random and Fixed effects models (columns 1 vs 2) are fairly similar, the standard errors being higher in the Fixed effects case. The Hausman test (Hausman, 1974; bottom of column 2) confirms that the hypothesis that both sets of coefficients are equal can not be rejected, meaning that district effects are not correlated with explanatory variables and that the Random effects model is the appropriate one. A similar procedure has been used in the case of year effects, although the tests are not shown in the table. The year effects are statistically significant in all the cases and the Hausman test suggest that they are indeed correlated with the explanatory variables, so they

[11] In short, the algorithm separately performs two calculations: ads and subtracts votes to the incumbent party (and redistributes them to the ideologically closest party) till the last seat assigned to the incumbent changes (he win an additional seat or he looses the last one he has). The variable used is the minimum of these two variables (see Castells and Solé-Ollé, 2005, for a discussion).

should be treated as fixed. In columns 3 and 4 we show that the fit of the model improves when we add some time-invariant variables. In any case, even with these additional controls the B-P statistic still favours the use of a Random effects model. Our preferred specification is the one in column 3, since the additional controls included in column 4 are not statistically significant at conventional levels. Columns (5) and (6) provide some additional checks on the appropriateness of our preferred specification of column (3). In column (5) we show what happens when we include the contemporaneous increase in income and population (as suggested by expression 17), and instrument income using the five-year lagged level of income and human capital stock. The Sargan test (bottom of this column) shows that these instruments are not correlated with the error term, and the partial F-test on the first-stage regression says that they have considerable explanatory power, since its value is higher than the threshold suggested by Stock and Yogo (2002). These results suggest that these two variables can be excluded from the model at no cost. Finally, column (6) illustrate the effects of including as explanatory variables a second lag of the investment effort and of the increases in income per capita and population. Note that a first lag of these variables has been included in all the specifications and that the Wald test (bottom of column 3) suggest that this increases the fit of the model. However, in the case of the second lag the Wald test suggest (bottom of column 6) that these variables are not statistically significant at conventional levels (the p-value is just 0.138) and can therefore be excluded from the specification.

(Insert Table 1)

As for the results, the top panel of Table 1 shows that the four political variables have the expected sign and are statistically significant for the full period. Moreover, the size of the coefficients is of a considerable magnitude. For example, an increase of 10% in the incumbents' *Vote margin* (e.g., a move from a peak vote share of 45% to either 35% or 55%) reduces the investment effort by 0.34% (e.g., if the mean investment effort is 6.1%, this would be reduced to 5.76%). Increasing one standard deviation in the variable *Marginal seat price* will reduce the investment effort a 1.56% (from 6.1% to 4.54%). Not being *aligned* with the central government or not being *pivotal* in the formation of the central executive will reduce the investment effort a 0.2% and a 0.5%, respectively (i.e., from 6.1% to 5.9% and 5.6%, respectively).

(Insert Table 2)

Table 2 presents these results for each of the 8 terms-of-office of the Spanish democratic governments. We also provide these results for each of the parties that have been in power (UCD, right from 1978 to 1982; PSOE, left from 1983 to 1996; and PP, right from 2000 to 2004), and also for the full democratic period. The top panel shows that the results of the *Vote margin* and *Marginal seat price* variables hold for the three different parties in charge and, with a couple of exceptions, for each one of the terms-of-office. PSOE left governments seem to have been a little less influenced by these tactical considerations. The coefficients for the UCD right governments seem to be the strongest ones. The *alignment* results only hold (at conventional statistical significance levels) in the PSOE case, the coefficients being of the expected sign but not statistically significant under the PP[12]. The *pivotal* party results also hold in all the cases, although they are also stronger in the case of the PSOE. Albeit showing some period heterogeneity, the results from Table 2 clearly confirm that tactical considerations have been in general quite important in Spain during all the democratic years.

Programmatic redistribution. The bottom panel of Tables 1 and 2 analyse the effect of economic variables on investment effort. The results suggest that investment effort is lower the higher the previous level of capital stock. For the full democratic period, the capital stock coefficient suggests that investment closes each year a 7.2% of the gap between actual and desired capital stock. This number is higher during the PSOE governments and lower during the PP ones, surely reflecting the different amounts of funds assigned to infrastructure investment at different moments. The results shown also say that the central government invests more in regions with less density of population and on the coast (although the coefficient is not statistically significant in all the sub-periods), taking into account the differential spending needs and/or costs of these areas (see also Castells *et al*, 2006). Any attempt to account for other factors, related either to needs/costs (e.g., climate, terrain ruggedness) or responsibilities has been unsuccessful.

Investment effort is affected positively by income, to the exception of the PSOE1 and PSOE2 terms-of-office (see Table 2). The row below the income results shows the *equity-efficiency trade-off* parameter (ϕ), with values that are positive and lower than one for most

[12] Note that these variables are not included in all the terms-of-office, the reason being that these phenomena are specific of the considered periods (i.e., it has no sense to talk about alignment before 1983 and there are only two governments that have been conditioned by pivotal regional parties).

of the sub-periods, to the exception of the two aforementioned left governments, that display negative but modest values. In relative terms, the UCD governments had an efficiency orientation (ϕ = 0.662), but they were the first governments to implement the new demands for redistribution that arose with democracy; note, for instance, the quasi-absolute efficiency-orientation of infrastructure investment during the dictatorship (ϕ = 0.902). Also the recent right governments (PP, between 1997 and 2004) have been more efficiency-oriented (ϕ = 0.678) than the previous left ones (PSOE, between 1983 and 1997), which put more emphasis on equity (ϕ =0.039). However, in no case the regional allocation of investment was fully efficient (this requires $\phi = 1$[13]).

The value of this parameter for each sub-period is also shown in Figure 3, which also plots the estimated ϕ value for each of the years of the sample. The inspection of the figure suggests several explanations to the time evolution of the value of this *equity-efficiency trade-off*. First, the arrival of democracy brought the first impulse to equity in the allocation of infrastructure investment. Second, left governments are more redistributive (equity-oriented) than right governments. Third, the maximum level of interregional redistribution occurred with the first PSOE left government. To understand this, recall that PSOE won the 1983 election by a huge margin; this fact, coupled with the desire to implement a long-delayed ideological program (this was the first left government in nearly half a century) could explain this intense equity orientation[14]. Fourth, the next redistributive impulse occurred in the PSOE 3rd term of office (1989-93), conditioned by the huge amount of EU funds that were earmarked to poor regions since the accession of Spain to the European Community. Fifth, the last PSOE government (1994-96) and the PP ones (1997-2004) sought an increase in the orientation of infrastructure investment towards efficiency. To understand the causes that might explain this result recall that, as shown in Figure 1, the amount of EU funds which were earmarked to poor regions and used to fund infrastructure investments decreased through time. This was due both to a decrease in the relative amount of money allocated to ERDF Objective 1 regions, and to the creation of the Cohesion Fund in 1993.

[13] Recall that in order to carry out this interpretation one has to set σ=1, since ϕ can not be formally identified. This means that some of the interpretation made in the text, regarding if the investment allocation is or not 'efficient' should be taken with caution. This, however, does not invalidate our analysis, since we focus on a comparison between different time periods, which we believe is legitimate if σ is more or less constant.

[14] See Boix (1998) for an analysis of the role of infrastructure investment in the ideological program of PSOE during those years.

But of course, there could be other explanations that can not be detected from a bird-eye inspection of the data. For instance, some of the *programmatic redistribution* theories (see section 2) suggest that the level of redistribution in a democratic system will be the one preferred by the most powerful group of citizens. This group could be either the median income region or a weighted sum of all the regions, where the weights reflect the 'political power' of each one. In our case, powerful could mean a lower *Vote margin*, a lower *Marginal seat price*, that the regional and central governments are *aligned*, or that regional parties are *pivotal* in the formation of the central executive. Thus, different theories lead to different predictions. If the median voter theory is true in our context, we should observe that the efficiency orientation of the government (i.e., ϕ) should increase as the *ratio between median and average income* increases. The other possibility is that the efficiency orientation of the government increases as the 'political power' of the electoral districts is less negatively correlated with income/is more positively correlated with income. That is, when poor/ rich regions become less/more powerful the degree of redistribution is reduced.

Table 3 presents the coefficients of the slope function $\phi_t = \phi_0 + \phi_1 \varsigma_t + \phi_2 \rho_t + \zeta_t$, which have been estimated by means of a Random coefficients model. This procedure is an attempt to test in a more systematic way the different hypotheses introduced up to the moment. Table 3 presents the long-run coefficient of the income variable (ϕ_0), once identified dividing the income coefficient by the long-run sluggishness parameter (δ), and the long-run coefficients on the interactions between income and the ς_t and ρ_t variables, identified in the same way. However, the equations also include all the variables used in Table 1 and 2, which are omitted here to save space. The Wald test shown at the bottom of the table indicates that the adding the interactions improve the fit of the model. Also the Likelihood Ratio test suggests that it is appropriate to consider the ϕ coefficient as random.

(Insert Table 3)

In the first column of Table 3 we test the so-called *constitutional* explanations for redistribution; that is, the hypotheses that say that the inter-territorial redistribution is basically affected by the arrival of democracy and of the EU funds. The results in column 1 do in fact show that the *equity-efficiency trade-off* was on average higher during the dictatorship (ϕ = 0.654, picked up by the constant term) than in the democratic period (ϕ = 0.44, computed as the sum of the coefficient of *Democracy* and the constant term).

Moreover, these differences are statistically significant. Also, the proportion of *Redistributive EU Funds* over infrastructure investment reduces the efficiency orientation of that investment. For each percentage point of *Redistributive EU Funding* the ϕ coefficient is reduced by 0.015. This means that at the peak of EU infrastructure funding in 1997 (where this share was the 19%) the predicted value of ϕ was 0.127 (= 0.654 – 0.244 – 0.015 × 19) and at the end of the period (where this share was just the 9%) the value of ϕ was 0.275. These results suggest that the arrival of EU funds had a sizeable effect on this redistribution.

In the second and third columns we present the result of what we call the *partisan* explanation for redistribution. The results in column 2 show a negative and strongly statistically significant coefficient for the *Left* variable. While a right democratic government has a predicted ϕ coefficient of 0.537 (= 0.659 – 0.122), the same parameter takes a value of 0.113 (= 0.659 – 0.122 – 0.424) for a left one. Column 3 tests a variant of the partisan theory, which states that ideology is mediated by the degree of electoral competition. We expect that in contested elections left parties will redistribute less (than they would do in uncontested elections) and right parties will redistribute more. We test this hypothesis by interacting the *Left* and *Right* dummies with a *Contested election* dummy, which takes a value of one for the years where the incumbent expected a narrow margin of victory/ defeat at the next general election and zero otherwise. The margin is computed as the absolute value of the difference between the incumbent's expected vote share and 38%, which is approximately the minimum vote share with which a Spanish government has been able to form government. The expected vote share is the average between the intended vote share for the incumbent at the moment of approving the budget (so, last trimester of the previous year) and the intended vote share at the middle of the execution period (so, second trimester of the current year), as provided by the CIS ('Centro de Investigaciones Sociológicas') polls. Then, we consider that the margin is narrow if it is less than 8%, which is the median margin for all the years in the sample. With this procedure, the *Contested election* dummy takes the value 1 for the years 1979-80, 1983-92 and 2002 onwards[15]. As can be seen in the table, *Left* governments still redistribute much less than the *Right* ones if the election is uncontested (the coefficient of the

[15] The low competition observed in the period 1981-82 was due to the demise of the UCD government, which intended vote dropped from 40% at the end of 1979 to 26% at the end of 1980 and to 10% at the end of 1982 (just before the elections won by the PSOE); the low competition during 1983-92 was due to the landslide victory of the PSOE in 1982, which had an intended vote share of 60% in 1984 and still of 50% in 1992; finally, the intended vote share was also quite high (46%) during the years 2000 and 2001 (just before and after of the elections that allowed the formation of a right single-party government).

Left dummy without interactions is negative and statistically significant). However, we observe now that *Right* governments redistribute more in contested than in uncontested elections. In fact, the ϕ coefficient drops by –0.220 between these two situations.

The fourth column of Table 2 tests the *Median Voter* theory of redistribution. However, the results are rather disappointing. The coefficient of the ratio between median and average regional income is not only statistically insignificant but its sign is opposed to the expected one. Other trials, adding the square of this ratio (searching for a kind of Kuznets curve, Kuznets, 1955) did not provide satisfactory results. Finally, the fifth column of Table 2 tests the hypothesis that the degree of redistribution is affected by the correlation between 'political power' and income per capita, ρ(*Power, Income*). We compute our measure of (relative) 'political power' as a geometrically weighted average of the variables *Vote margin*, *Marginal seat price*, *Partisan alignment* and *Pivotal regional party*, with weights which are specific to each term-of-office (see Table 2)[16]. The results suggest that this variable has a positive and statistically significant effect over redistribution. Additional results, disentangling this variable in its different components and not displayed here, show that all of them have a positive and significant effect. An additional intriguing effect of the inclusion of this variable is that the coefficients of both *Democracy* and *EU Funds* are no longer statistically significant at conventional levels. The results for the ideological variables remain the same. This would mean that the degree of inter-territorial redistribution is at a practical level less determined by constitutional rules and laws that try to channel funds towards less developed regions, but depends basically on the ideology of the party in office and on the electoral incentives that this party faces in each election.

5. Conclusion

Central governments have considerable discretion in the allocation of infrastructure investment across regions. Being this the case, it is natural to expect that pork barrel influences (what we call *tactical redistribution*) do shape (at least partly) the regional allocation of investment. In this paper we have shown that, after controlling for important economic traits of Spanish electoral districts (income, capital stock, land area), the districts that are more

[16] The results regarding this variables are virtually unchanged if the weights used are the same for all periods in the case of the variables *Vote margin*, *Marginal seat price* and *Pivotal regional party*, but the performance of this variable less satisfactory if one imposes a unique weight on the *Partisan alignment* variable, which is the one with more heterogeneous results.

'politically productive' still receive disproportionately high amounts of investment. These districts are those were there is a high proportion of *swing* voters (voters that are not specially attached to any of the parties), were the 'marginal price of a seat' is low (less votes are needed to win an additional seat), were the regional government is controlled by the same party than the central one, or were there are regional parties that are pivotal in the formation of the central executive.

However, we also argued that it is not true that infrastructure investments are fully discretionary and, therefore, that *programmatic redistribution* theories explain also a part of the story. The equity orientation of the regional allocation of infrastructure investment is conditioned by constitutional rules, understood in a broad sense, including both the mandate of the Spanish Constitution but also the effects of EU policies. These rules constraint the investment allocation possibilities, forcing politicians to design formula-based allocations based basically on regional income. This is the realm of programmatic regional redistribution, where the government basically determines the weight given to income in the allocation of investment, what we call his *equity-efficiency trade-off* or 'taste for redistribution'. We have shown in the paper that the long-run effect of income on the investment effort is lower than one, meaning that the allocation of investment is not only efficiency-oriented[17]. The weight given to equity was very low during the dictatorship, increased with the arrival of the democracy and, especially, after the first left government, and again after *EU Funds* began to flow to Spain. In the paper we try to test these highly intuitive explanations against some others derived from several theories of *programmatic redistribution*. We show that both the *Democracy* and *EU Funds* did have some effects over inter-territorial redistribution, but that these effects vanished after accounting for politics. Ideology seems to be a more powerful determinant of the equity orientation of infrastructure investment, left government redistributing much more than right ones. Also, redistribution seems to decrease as less developed regions lose some of its early 'political power'.

Overall, the results suggest that the allocation of infrastructure investment in Spain is less constrained by rules than is generally believed, and much more influenced by politics, both by particularistic politics (*tactical redistribution*) but also by programmatic considerations (*programmatic redistribution*) that end up influencing how formulas are

[17] The excessive orientation towards equity of the Spanish regional allocation of investment has also been pointed out by other authors (see, especially, De la Fuente, 2004 and 2007).

determined. To conclude, just to say that the reason that a region receives less investment that it deserved are basically two: (i) the region has low 'political power', so it will receive less monies that other regions with the same 'objective' traits, and (ii) the regions' peers (e.g., if the region is poor, the other poor regions, if it is rich the other rich regions) have low 'political power', so the overall pattern of redistribution runs against the interest of the region (if it is poor, the allocation is too efficiency-oriented, if it is rich, too equity oriented). A really intriguing question is why the central government tries to buy votes trough the programmatic design of investment policies or intergovernmental grants instead of using more particularistic spending. After all, it is much cheaper to please a given poor region which is especially powerful, than to channel more funds to all the poor regions (some of them might not be that powerful, even when the average poor regions are). Probably, the reason for the use of *programmatic* rather than *tactical* redistribution is that the government can make only limited use of discretionary funds (not respecting any a priori established 'objective' criteria), because otherwise the electorate and/or the media will notice it.

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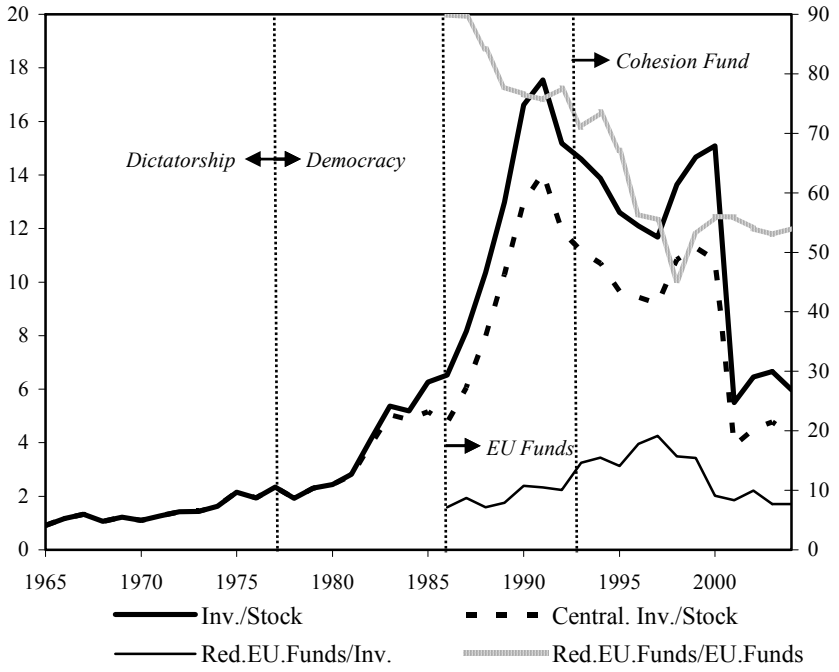
Figure 1:
Infrastructure investment (*as a % of capital stock*) *in Spain* 1964-2004.
Total and Central infrastructure investment, & share funded by the EU

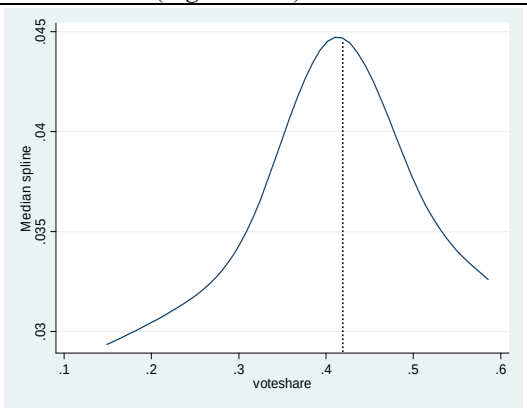


Notes: (1) Inv./Stock: Central + Regional government infrastructure investment (as a % of infrastructure capital stock); Central. Inv.Stock: Central government infrastructure investment (as a % of infrastructure capital stock); Red.EU.Funds /Inv.: EU Funds earmarked to poor regions (measured as ERDF Objective 1 Funds) & used to fund infrastructure investment as a share of Central + Regional government infrastructure investment; Red.EU.Funds/EU.Funds: EU Funds earmarked to poor regions & used to fund infrastructure investment as a share of total EU funds used to fund infrastructure investment. (2) Investment on the left y-axis and EU funds on the right y-axis.

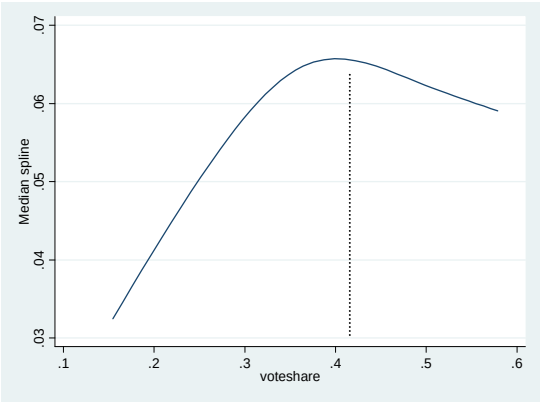
Data Sources: (1) Fundación BBVA (2004, 2007) for investment and capital stock; (2) Ministerio de Economia y Hacienda (several years) for EU funds.

Figure 2:
Relationship between Infrastructure investment (*as a % of capital stock*) *and incumbent vote-share in Spain, Median spline for different periods*

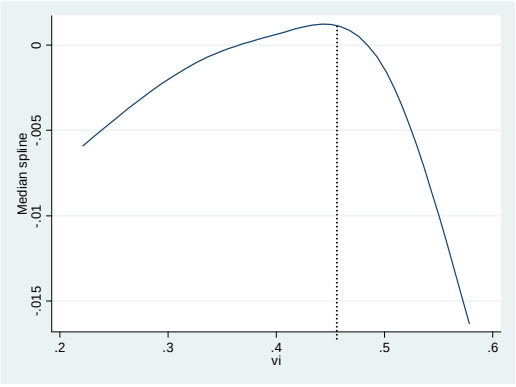
Period 1978-82 (*Right:* UCD)



Period: 1983-1996 (*Left:* PSOE)

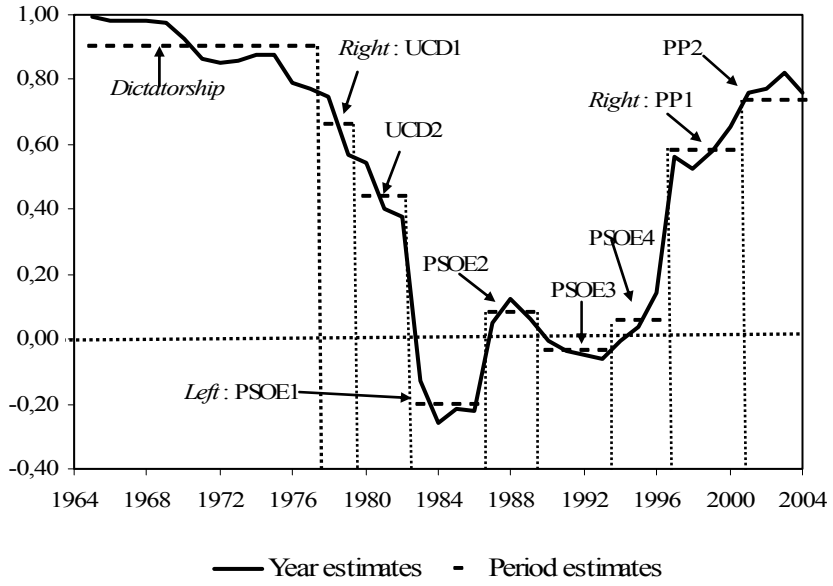


Period 2000-04: (*Right.*: PP)



Notes: (1) x-axis: incumbent's vote share; y-axis: median spline of infrastructure investment (as a % of capital stock); (2) estimation method: median spline estimation using as dependent variable the residual of a regression between infrastructure investment, economic controls (GDP per capita, capital stock, land area, coast) and year dummies; (3) See Figure 2 for Party acronyms and Data sources.

Figure 3:
Equity-efficiency trade-off (ϕ) *for infrastructure investment.*
Spain, *Period* 1964-2004 *and sub-periods*



Notes: Equity-efficiency trade-off (ϕ) is the 'long-run' elasticity of investment to income, obtained after estimating a regression between infrastructure investment (as a % of infrastructure capital stock) and GDP per capita, controlling for the capital stock and other economic and political covariates (see Notes of Table 1 for additional methodological details). Dotted line are the term-of-office specific estimates (Table 2) and the Bold line the year estimates using the coefficients of Table 3.

Table 1:

Economic and political determinants of the regional allocation of infrastructure investment in Spain. Democratic period (1978-2004). *Dependent variable* $i=I/C_{-1}$. *Obs*.= 26×50(T×N)=1,300

	(1) GLS- *Random effects*	(2) OLS- *Fixed effects*	(3) GLS- *Random effects*	(4) GLS- *Random effects*	(5) IV- *Random effects*	(6) GLS- *Random effects*
(i) *Political factors*						
Vote margin (*in* %)	-0.030 (-7.15)***	-0.029 (-3.23)***	-0.034 (-7.15)***	-0.034 (-7.18)***	-0.031 (-6.83)***	-0.030 (-7.12)***
Marginal seat price ($\times 10^{-4}$)	-0.019 (-2.71)***	-0.021 (-2.14)***	-0.026 (-2.71)***	-0.025 (-2.66)***	-0.024 (-2.93)**	-0.023 (-2.23)***
Partisan alignment	0.002 (1.86)*	0.002 (1.55)	0.002 (1.83)*	0.002 (1.78)*	0.002 (1.70)*	0.002 (1.66)*
Regional pivotal party	0.005 (3.45)***	0.005 (2.24)**	0.005 (3.21)***	0.005 (3.10)***	0.005 (3.34)***	0.005 (3.02)***
(ii) *Economic factors*						
ln(*Capital stock p.c*)	-0.068 (-15.35)***	-0.069 (-6.22)***	-0.072 (-15.71)***	-0.072 (-15.55)***	-0.070 (-13.44)***	-0.068 (-15.36)***
ln(*Income p.c.*)	0.031 (4.88)***	0.030 (2.55)**	0.034 (4.88)***	0.033 (4.25)***	0.032 (4.25)***	0.030 (4.17)***
ϕ [*s.e.*]	0.456 [0.064]***	0.435 [0.134]***	0.472 [0.074]***	0.472 [0.087]***	0.457 [0.083]***	0.441 [0.092]***
ln(*Land area p.c.*)	--.--	--.--	0.004 (7.96)***	0.004 (7.45)***	0.004 (6.99)***	0.004 (7.77)***
Coast	--.--	--.--	0.003 (4.98)***	0.003 (4.94)***	0.003 (4.65)***	0.003 (4.42)***
Island	--.--	--.--	--.--	-0.011 (-0.981)	--.--	--.--
% Days freezing	--.--	--.--	--.--	0.001 (0.123)	--.--	--.--
% Land over 1000 *m*	--.--	--.--	--.--	0.002 (0.187)	--.--	--.--
Responsibilities	--.--	--.--	--.--	0.696 (1.221)	--.--	--.--
Δ ln(*Income*)	--.--	--.--	--.--	--.--	0.005 (1.554)	--.--
Δ ln(*Population*)	--.--	--.--	--.--	--.--	0.323 (1.123)	--.--
R^2	0.478	0.397	0.499	0.501	0.518	0.510
F-test [*p-value*]	18.23 [0.00]	14.68 [0.00]	20.11 [0.00]	25.88 [0.00]	24.43 [0.00]	23.56 [0.00]
B-P LM-test (*Var*(*u*)=0)	56.33 [0.00]	--.--	45.22 [0.00]	--.--	--.--	--.--
Hausman test (*fe vs.re*)	--.--	10.00 [0.35]	--.--	--.--	--.--	--.--
Sargan test (*inst. validity*)	--.--	--.--	--.--	--.--	1.35 [0.37]	--.--
1*st stage F-test* (*weak inst.*)	--.--	--.--	--.--	--.--	25.22 [0.00]	--.--
Wald test (1-*year lags*)	--.--	--.--	35.78 [0.00]	--.--	--.--	--.--
Wald test (2-*year lags*)	--.--	--.--	--.--	--.--	--.--	6.75 [0.138]
Year fixed effects	YES	YES	YES	YES	YES	YES
District fixed effects	NO	YES	NO	NO	NO	NO
1-*year lags*	YES	YES	YES	YES	YES	YES
2-*year lags*	NO	NO	NO	NO	NO	YES

Notes: (1) z-statistics in parentheses, ***, ** & * = statistically significant at the 99%, 95% and 90% levels; standard errors and p-values in brackets; (2) ϕ= *equity-efficiency trade-off*, computed as the ratio between the coefficient of income and that of the capital stock (in absolute value); (3) *B-P LM-test* (*Var*(*u*)=0) = Breusch-Pagan Lagrange Multiplier test of the appropriateness of the random effects model, distributed as a $\chi^2(1)$; (4) *Hausman test* (*fe vs.re*) = Hausmant test of the appropriateness of the random vs the fixed effects model, distributed as a $\chi^2(k)$ with k=number of variables; (5) Sargan test = test of validity of the instruments, distributed as a $\chi^2(k)$ with k=number of added instruments; (6) 1*st stage F-test* = added instruments' partial F-statistic of the first-stage regression; (7) *Wald* (1-*year lags*) & *Wald* (2-*year lags*) = Wald test son the significance of 1-year (Δln(*Income*$_{-1}$), Δln(*Population*$_{-1}$, $i_{-1}=I/C_{-1}$) and 2-year (Δln(*Income*$_{-2}$), Δln(*Population*$_{-2}$, $i_{-2}=I/C_{-2}$) lagged variables, distributed as a $\chi^2(k)$.

Table 2:

Economic and political determinants of the regional allocation of infrastructure investment in Spain: (1964-2004 *and subperiods*). *Dep. variable* $i=I/C_{-1}$.

Period:	1978-79	1980-82	1978-82	1983-86	1987-89	1990-93	1994-96	1983-96	1997-00	2001-04	1997-04	1978-04	1964-77
Regime/Party	UCD1	UCD2	**UCD**	PSOE1	PSOE2	PSOE3	PSOE4	**PSOE**	PP1	PP2	**PP**	***Dem.***	***Dic.***
(i) *Political factors*													
Vote margin (*in* %)	-0.162 (-3.66)***	-0.102 (-3.76)***	-0.147 (-3.14)***	-0.144 (-1.57)	-0.172 (-3.34)***	-0.106 (-2.23)**	-0.122 (-1.77)*	-0.057 (-2.33)***	-0.075 (-2.13)***	-0.127 (-2.71)***	-0.079 (-2.17)***	-0.034 (-7.15)***	--.-
Marginal seat price ($\times 10^{-4}$)	-0.005 (-2.38)***	-0.004 (-5.36)***	-0.005 (-2.51)***	-0.002 (-2.46)***	-0.002 (-1.24)	-0.002 (-2.22)**	-0.001 (-2.10)***	-0.001 (-3.87)***	-0.003 (-5.30)***	-0.002 (-1.39)	-0.005 (-5.61)***	-0.026 (-2.71)***	--.--
Partisan alignment	--.--	--.--	--.--	0.003 (1.65)*	0.010 (2.31)***	0.014 (1.89)*	0.007 (1.55)	0.005 (2.19)***	0.003 (1.34)	0.004 (1.54)	0.004 (1.20)	0.002 (1.76)*	--.--
Regional pivotal party	--.--	--.--	--.--	--.--	--.--	--.--	0.014 (2.14)**	0.012 (2.51)***	0.006 (2.23)**	--.--	0.006 (2.20)**	0.005 (3.21)***	--.--
(ii) *Economic factors*													
ln(*Capital stock p.c.*)	-0.077 (-2.76)***	-0.063 (-2.72)***	-0.068 (-3.13)***	-0.049 (-10.25)***	-0.101 (-11.31)***	-0.103 (-5.91)***	-0.089 (-7.77)***	-0.084 (-13.28)***	-0.048 (-2.14)**	-0.077 (-3.90)***	-0.042 (-4.94)***	-0.072 (-15.71)***	-0.079 (-12.89)
ln(*Income p.c.*)	0.050 (3.04)***	0.028 (2.70)***	0.045 (5.72)***	-0.010 (-3.11)***	0.008 (3.47)***	-0.004 (-2.15)**	0.005 (1.81)*	0.003 (4.00)***	0.028 (4.82)***	0.027 (4.56)***	0.025 (4.04)***	0.034 (4.88)***	0.071 (6.92)***
ϕ [*s.e.*]	0.685 [0.236]	0.440 [0.163]	0.662 [0.166]	-0.205 [0.041]	0.082 [0.018]	-0.038 [0.019]	0.058 [0.034]	0.039 [0.011]	0.580 [0.181]	0.732 [0.203]	0.678 [0.170]	0.472 [0.074]	0.902 [0.113]
ln(*Land area p.c.*)	0.006 (0.231)	0.005 (0.110)	0.007 (0.328)	0.021 (4.38)***	0.015 (4.51)***	0.031 (6.16)***	0.022 (4.14)***	0.023 (2.75)***	0.008 (0.654)	0.010 (0.654)	0.009 (0.543)	0.004 (7.96)***	0.004 (0.871)
Coast	0.003 (0.120)	0.003 (0.098)	0.002 (0.134)	0.009 (2.89)***	0.008 (1.60)	0.004 (1.13)	0.019 (4.56)***	0.005 (2.34)**	0.002 (0.221)	0.001 (0.189)	0.003 (0.320)	0.003 (4.98)***	0.002 (1.210)
R^2	0.398	0.391	0.393	0.546	0.620	0.515	0.512	0.550	0.235	0.239	0.228	0.333	0.276
F-test [*p-value*]	13.40 [0.00]	18.50 [0.00]	15.02 [0.00]	28.18 [0.00]	31.68 [0.00]	27.71 [0.00]	26.23 [0.00]	29.23 [0.00]	9.21 [0.00]	9.78 [0.00]	8.70 [0.00]	28.68 [0.00]	9.871 [0.00]

Notes: (1) z-statistics in parentheses, ***, ** & * = statistically significant at the 99%, 95% and 90% levels; standard errors and p-values in brackets; (2) ϕ= *equity-efficiency trade-off*, computed as the ratio between the coefficient of income and that of the capital stock (in absolute value); (3) Method of estimation: GLS(random effects) with time effects and 1-year lags of income, population and investment effort (i.e., $\Delta\ln(Income)_{-1}$, $\Delta\ln(Population)_{-1}$ & $i_{-1}=I_{-1}/C_{-2}$).

Table 3:
Determinants of the Equity-efficiency trade-off (ϕ) *in the regional allocation of infrastructure investment, Spain* 1964-2004. *Dependent variable* $i=I/C_{-1}$.
Obs.= 26×50(T×N)=1,300. *ML-Random coefficients estimation*

	(1) *Constitutional*	(2) *Partisan*	(3) *Partisan*	(4) *Median voter*	(5) *Political power*
Constant	0.654 (7.36)***	0.659 (7.88)***	0.653 (7.95)***	0.724 (9.37)***	0.811 (16.80)***
Democracy	-0.244 (-2.66)***	-0.122 (-1.82)*	-0.010 (-1.93)*	-0.112 (-1.55)	-0.100 (-1.46)
Red. EU Funds / Investment	-0.015 (-5.77)***	-0.004 (-2.73)***	-0.005 (-3.41)***	-0.005 (-2.67)***	-0.002 (-1.210)
Left	--.--	-0.423 (-10.25)***	-0.599 (-14.56)***	-0.574 (-10.68)***	-0.546 (-13.57)***
Left × *Contested election*	--.--	--.--	0.082 (0.73)	0.081 (0.74)	0.123 (0.50)
Right × *Contested election*	--.--	--.--	-0.220 (-4.60)***	-0.234 (-4.86)***	-0.216 (-4.99)***
Median income/Income	--.--	--.--	--.--	-0.012 (-0.72)	--.--
ρ(*Power, Income*)	--.--	--.--	--.--	--.--	0.332 (4.57)***
Wald test [*p-value*]	77.13 [0.00]	105.98 [0.00]	123.96 [0.00]	124.15 [0.00]	134.42 [0.00]
Wald test (*interactions*)	19.22 [0.00]	45.25 [0.00]	66.87 [0.00]	67.00 [0.00]	78.11 [0.00]
LR test (*vs. linear regression*)	45.13 [0.00]	45.98 [0.00]	43.96 [0.00]	48.15 [0.00]	48.42 [0.00]

Notes: (1) z-statistics in parentheses, ***, ** & * = statistically significant at the 99%, 95% and 90% levels; standard errors and p-values in brackets; (2) Method of estimation: GLS-Random coefficients, the table showing the estimated function $\hat{\phi}_t = \hat{\phi}_0 + \hat{\phi}_1 \varsigma_t + \hat{\phi}_2 \rho_t$ of expression (15), obtained after dividing all the coefficients by the estimated sluggishness parameter; (3) All the equations include as controls: all the political and economic variables shown in Table 2 plus time effects and an 1-year lags of income, population and investment effort; (4) *Wald* & *Wald* (*interactions*) = tests on the joint statistically significance of all the variables in the equation and of the interaction terms, respectively; (5) *LR test* (*vs. linear regression*) = Likelihood Ratio test of the appropriateness of considering random coefficients, distributed as a χ^2(k) with k=number of random coefficients; (5) Red.EU.Funds/Investment = share of infrastructure investment funded by European Union redistributive funds (see Figure 1 for a definition); Left = PSOE executives (1983-1996); Contested election = election with an a priori uncertain outcome; Median Income/Income = ratio between median GDP per capita and average GDP per capita; ρ (*Power, Income*) = correlation between political power and GDP per capita = weighted sum of *Electoral margin*, *Marginal seat price*, *Partisan alignment* & *Pivotal regional party*, with weight obtained from previous estimations (Table 2).

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