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Fungibility and bandwagon effects of capital transfers in a federal context

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Abstract
The authors quantify the fungibility effect or diversion of resources towards purposes other than investment, by regions receiving conditional capital transfers. To identify this behaviour, they have taken different empirical approaches with frontier techniques that let them quantify whether the regions are investing the maximum available funds, given certain environmental factors. The results show that Spanish regions divert hardly any of their potential investments, and that the most prosperous regions are the ones that let the most resources leak into other uses, especially in economic boom periods. In contrast, in some poor regions the authors can identify the opposite phenomenon, in which resources are dragged along towards investment (bandwagon effect). They identified several factors explaining the fungibility effect: political aspects, poor management or planning associated with the accumulated debt, the political cost of tax collection, and other variables such as the level of economic development, population density, and the economic cycle.

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Keywords capital transfers, regional capital expenditure, fungibility effect, bandwagon effect, frontier techniques

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FUNGIBILITY AND BANDWAGON EFFECTS OF CAPITAL TRANSFERS IN A FEDERAL CONTEXT

1. Introduction

Collaboration between levels of government to achieve certain economic policy objectives, such as territorial development or rebalancing, is one of the essential arguments justifying the existence of intergovernmental transfers. However, it becomes more difficult to meet these objectives when part of the grants received, tied to certain specific uses, are used for other purposes by the recipient governments. There is empirical international evidence quantifying this fungibility of conditional capital transfers in very specific fields, such as education or child welfare. However, this literature focuses on spending, ignoring the other funding sources available to the recipient jurisdictions for these capital expenditures.

To see whether donor governments have any reason to be worried about the final destinations of the grants they contribute, this work quantifies the diversion of resources by regions receiving conditional capital transfers. Our approach and methodology differ from the methods used to date in the available literature. Based on frontier investment estimations, we calculate the divergence between actual and potential investment, identifying this divergence as the *fungibility effect*. The capital expenditure of a region depends on its revenue available for that purpose, but not only on that, as different environmental factors also affect expenditure. For this reason, we think that frontier techniques are suitable for determining the investment potential of the region, as they are based on a comparative analysis of the best regional investment behaviour (rather

than the average behaviour considered in other methodologies), given similar financial resources. We also use the recently developed non-parametric partial frontier techniques to approach the possible existence of the opposite phenomenon: the *bandwagon effect*, dragging resources towards investment, which has received very little analysis in the literature.

We do this for the 17 Spanish regions in the period 1991-2011, which includes economic booms and crises. This will let us analyse the regions' investment response to the transfers they receive (fungibility/bandwagon effect) through the changes of the economic cycle. Also, the case of Spain is very interesting for these analyses because of the great efforts made by the European Union and the Spanish State to promote regional development, above all by means of large capital grants, especially to backward regions. The results obtained clearly show that Spanish regions divert hardly any resources from their intended investment purposes, with the most prosperous regions diverting the most from their potential investment or frontier. In poorer regions, we may even see the opposite effect of resources being dragged along by the conditional grants, given that some of them invest more in capital expenditure than the best-performing regions with similar financial resources. The explanatory factors we have found for this asymmetry in the investment behaviour of the regions include political aspects, poor management or planning associated with the accumulated debt, the political cost of tax collection, and other factors such as the level of economic development, population and population density, and the economic cycle.

The work is structured as follows. The second section discusses the goals of the study from a theoretical point of view and reviews the available literature. The third section describes the non-parametric partial frontier methodology, the sample, the variables used in the estimations, and the results obtained. These non-parametric

techniques enable us to identify a significant asymmetry in the regions' investment behaviour, which is ratified in the fourth section by the parametric Stochastic Frontier Analysis. As well checking the robustness of the previous results, the stochastic frontier approach lets us improve the explanation of the investment potential and identify the socioeconomic and political factors explaining the *fungibility effect*. We end the work with our conclusions.

2. Problem statement and literature review

The literature has shown that the effects of a transfer on expenditure depend on the amount of the transfer, and the spending habits and preferences of the receiving government (Rego, 2002). Fiscal federalism theory (Bradford and Oates, 1971) shows us that if the income elasticity of capital expenditure is greater than 1, when it receives the transfer the receiving government will take funds from current spending to allocate to investment. If the receiving governments are required to co-finance a percentage of the subsidised capital goods (compensatory transfers), the donor and receiving administrations will share the investment cost, reducing the price of capital expenditure for the receiver. In this case, the final result will also depend on the price elasticity of capital expenditure: if it is greater than 1, the receiving government will take funds from other uses and allocate them to capital goods, while if less than 1, part of the transfer will be allocated to current expenditure. Therefore, according to the conventional analysis, we can predict that compared to a compensatory conditional transfer, *ceteris paribus* there will be a lower investment level with an unconditional transfer of the same amount or a conditional block grant, as these stimulate spending through an income effect, while the conditional transfer adds a substitution effect which reinforces the expansion of capital expenditure.

Meanwhile, as long as a conditional grant stimulates investment beyond the preferences of the jurisdiction, there will be incentives for the jurisdiction to work towards its own preferences (Bradford and Oates, 1971, and Hines and Thaler, 1995) and divert resources to other purposes, such as reducing taxes, debt or the current deficit; increasing current spending; or even mismanagement of these resources[1].

In this way, if there is a strong leakage effect, a conditional grant will essentially be equivalent to an unconditional grant, and will therefore have a very limited effect on investment. However, to prevent this reallocation of resources, measures can be implemented such as requiring an obligatory volume of investment, or that the receiving government contribute more of its own resources than the grant received, or maintains its tax effort (Zampelli, 1986). Alongside this, supervision and control systems are crucial, as is choosing the right design for scheduling transfers, which must be conditional and require co-financing.

However, it may happen that the measures adopted to prevent the reallocation of resources are strong enough to cause the opposite phenomenon - in other words, the regions receiving the transfers have to complement them in order not to lose them, which can produce a *bandwagon effect*, dragging more resources towards investment than is economically sustainable, even against the wishes of the jurisdictions in the absence of grants[2]. The same will happen if the amount of the transfer received does not cover the desired investments of the receiving government, and it tries to supplement the transfer amount with its own resources, mainly when there is a significant lack of

[1] Receiving governments have various strategies for diverting resources (McGuire, 1979; Islam, 1998; Petchey and MacDonald, 2007; Leiderer, 2012): acquiring equipment which will be used in other services; redefining spending categories; financing fixed general expenditures of other non-subsidised programmes; selling the subsidised good in the market; or replacing their own resources, initially allocated to the subsidised function, with transferred funds and freeing up those resources for other purposes.

[2] In this case, the sub-central government could be taking on future maintenance and current expenditure linked to this capital expenditure, which it cannot afford with its current available funding.

investment. To sum up, the transfers received can cause a *bandwagon effect*, leading the receiving government to make a greater investment effort than its available resources permit, taking funds from other expenditures which will be abandoned, or obtaining them from other sources, such as debt or taxes. Sagbas (2001) and Sagbas and Tolga (2008) analyse this bandwagon or stimulation effect for Turkey in the context of transfers and local spending, distinguishing it clearly from the *flypaper effect*, according to which local governments spend more if they receive an unconditional transfer from a higher level of government than if their own revenues increase. The *flypaper effect* has been widely studied in the applied literature (see the survey by Gamkhar and Shah, 2007).

A review of the extensive empirical literature on grants is outside the scope of this work, although we should highlight the influential contribution of McGuire (1975 and 1978), which changed the methodology of the studies about the impact of conditional transfers (reviewed in Gramlich, 1977). Treating the price and income effects caused by these transfers as unknown parameters, McGuire quantified fungibility in the education sector at 70%. This work was followed by many more, some applied to other sectors[3]: for example, Zampelli (1986) placed the diversion of conditional transfers to local services at 40% to 70%; Meyers (1987) and Van de Walle and Mu (2007), who analysed the roads sector, found 63% to 85% leakage; Gold and Lowenstein (1996) and Gordon (2004) focused on education (10-80%); Islam (1998) on transport and healthcare (around 25%); and Ulbrich (2011) analysed the fungibility effect in child protection programmes, which has been very widely studied, with widely differing results (see the survey by Ribar and Wilhelm, 1999)[4]. In Spain hardly any

[3] However, not all studies find evidence of the diversion effect. For example, see Sha (1989).

[4] Other complementary papers study international aid programmes (Leiderer, 2012 and Morrisey, 2015).

evidence has been found for the fungibility of capital transfers (Lago-Peñas, 2006 and Fernández et al., 2013).

Analyses of the *fungibility effect* of capital transfers usually suffer from a series of limitations (Islam, 1998; McGillivray and Morrissey, 2013; Payne, 2009). On one hand, they are usually specified incorrectly, omitting important political, fiscal and institutional aspects. They usually use least square techniques which are not suitable for resolving econometric problems such as endogeneity and biases due to omitted variables. On the other hand, most of them merely quantify the fungibility or diversion effect, without explaining the reasons for the phenomenon or how it affects the response in terms of the subsidised expenditure. Also, in the few cases where they estimate the causes explaining divergences in the fungibility of conditional subsidies (Islam, 1998), they use a two-step procedure which can introduce biases in the estimations. Very few works consider the existence of the opposite phenomenon: resources dragged along towards investment. Finally, and perhaps most importantly, their analysis is usually partial, focusing on spending without simultaneously considering the other sources of funding of the recipient of the grant.

There are works which analyse the partial response to transfers in terms of debt and/or tax effort (Morrissey, 2015; Delgado et al., 2015), but they do not include the changes which these transfers cause in the subsidised expenditure in question. This makes the work of Payne (2009) particularly interesting, as it indicates that a connection should be established between subsidised public expenditure and the other own or sub-central sources of funding for such expenditure. In fact, given the budget restriction faced by any government, it can be inferred that capital expenditure is a function of income from capital transfers, current savings and net debt.

Alongside this, the shrinkage of funding sources due to the economic crisis and the subsequent budget tensions have demonstrated that sub-central governments can react not only by raising the public deficit, increasing tax pressure or reducing public investment and other expenditure; they may also focus on managing public spending more efficiently. The possible influence that the different environmental factors (such as the quality of management in different regions, the decisions each region makes regarding the illegal diversion of resources for purposes other than capital expenditure, etc.) may have on the investment behaviour of the regions means that determining the investment potential of a region not only depends on its funding sources, but also on causes which are difficult to capture in econometric models; hence, they must be included via a comparative analysis of the investment behaviour of the other regions. For this reason, our work connects the regions' investment efforts to their funding sources, using frontier methodologies to analyse management efficiency. This approach lets us determine the maximum capital expenditure levels which can be reached for given resources, through the comparative analysis of the behaviour of different regions (capturing the environment factors), and quantify the *fungibility effect*, or alternatively, the *bandwagon effect* by comparing it with the actual capital expenditure of each region[5].

3. Non-parametric frontiers of investment and the effects of transfers

In this first stage of our work, we intend to measure the divergence between the actual and potential investment of the regions, in order to see how far conditional capital

[5] Some of these frontier techniques have been widely used to analyse the efficiency of public spending, using public spending as input and an indicator of the goals of the spending programme as output (the survey in Afonso and Fernandes, 2008, may be of interest).

transfers, received by regional governments to reinforce their investment in specific ways, are used for other purposes.

3.1 Methodology

We think that frontier techniques, which are usual in the analysis of efficiency of companies' production, should work well in the sphere of funding for capital expenditure, insofar as investment can be considered as the output of the donor government's policy, which will be the function of a series of inputs - the financing sources available to the regions receiving the grants for making these investments. Also, both companies and governments are worried about the potential output (production or investment) which is unrealised. In the field of the production frontier this gap represents the level of inefficiency which a company cannot overcome, while in the field of public capital expenditure which concerns us here, it represents the unused investment potential or resource diversion effect, and could be caused by at least two groups of factors. On one hand, because the regional government wants to prioritise the provision of services to its citizens (current spending), the payment of financial costs, and/or a reduction in tax pressure or debt, whether for political reasons, the pressure of the crisis, or for having demanded a high level of tax effort from the citizens. And on the other, because there may have been poor practices in the planning and management of investment projects due to corruption, managerial incompetence by the governments, or a lack of suitable human resources, all of which could be considered an "unproductive" diversion of resources, or literal inefficiency. In all cases, the gap (fungibility/bandwagon effect) detected by any of the frontier techniques we are going to use must not be identified with the inefficiency in the provision of public capital expenditure which the literature has tried to explain (Afonso and Fernandes, 2008),

because this inefficiency could be precisely the cause of an excessive capital expenditure.

In this work we use a non-convex version of Data Envelopment Analysis, the Free Disposal Hull (FDH) proposed by Deprins et al (1984). This is a non-parametric technique which facilitates the construction of a frontier, within which the regions with the maximum investment level given certain financial resources would be located, so that a region's distance from the frontier would measure the *fungibility effect*. However, since this technique suffers from a series of problems (dimensionality problems, given its slow convergence rate; results are sensitive to outliers and measurement errors; and it does not let decision-making units be located beyond the frontier, so it cannot capture the possible *bandwagon effect* of transfers), we also use recently developed methods to evaluate efficiency for a partial frontier, which do not envelop all the data.

Specifically, these are two robust approaches: Order-m (Cazals et al, 2002) and Order-α (Aragon et al, 2005), which Simar and Wilson (2013) develop in great detail. Both are generalisations of the FDH, so they are still non-parametric techniques, but permit super-efficient observations; in other words, located beyond the estimated frontier of possible investments, making the results much less sensitive to measurement errors and outliers, and eliminating the well-known "curse of dimensionality". In this way, if there are no budget measurement errors, the super-efficiency these techniques can identify could correspond to a *bandwagon effect* on resources, in the sense that the jurisdictions located beyond the frontier will be outliers for the high volume of their investment effort, given the size of their financing sources and the behaviour of the other regions considered.

When constructing the investment potential or frontier investment with all observations, the FDH will always offer results equal to 1 or less than 1; in other words,

results identifying either behaviour in accordance with funding capacity (when the result or investment effort is 1) or diversion of resources to other purposes, called *fungibility effect* (when the result is less than 1), but never bandwagon effects. However, as partial frontier techniques allow observations to be located beyond the frontier or maximum investment, they will identify the bandwagon phenomenon, dragging resources towards the subsidised capital expenditure. This *bandwagon effect* will be produced when the result is greater than 1, with a super-efficient region, in the sense that it invests more than the region with the best behaviour in the considered cohort of jurisdictions with similar financial resources. In contrast, a result less than 1 will indicate that a region is investing less than the region with the best investment behaviour in the sample - in other words, it is diverting resources to other purposes.

3.2. Database and variables

For these calculations we use panel data for the 17 Spanish regions over 21 years (1991-2011). This allows us to capture the possible variations in public activity with the economic cycle, and thus, the oscillations of the financial restrictions that regional governments have to handle.

Our output is the region's capital expenditure in terms of its income, KE_{GDP}, including both direct investment and transfers, to avoid the risks arising from the possible substitutability and interdependence of different types of investment. This form of measuring output comes from adopting the point of view of the donor government and its concern about unused potential capital expenditure. Table 1 shows the definition of each variable used, the source of the data, and the main descriptive statistics. Table 1.A of the appendix shows the correlation matrix for the variables considered.

Table 1: Definition of the variables used and their sources

Variables	Description of the variable	Information source	Mean	Std. Dev.	Min	Max
INDEPENDENT VARIABLE						
KE_{GDP}	Capital expenditure (direct investment and transfers) of the region / Regional income	General Secretariat of Regional and Local Coordination (SGCHL) and National Statistics Institute (INE)	24.35	12.49	3.31	71.87
EXPLANATORY VARIABLES OF THE STOCHASTIC FRONTIER ANALYSIS OF CAPITAL EXPENDITURE						
Sources of financing						
IKT_{GDP}	Income from capital transfers / Regional income	SGCHL (data on settlements) and INE	8.63	6.84	1.00 E-11	42.82
$DEBT_{GDP}$	Debt level / Regional income		8.75	8.91	1.00 E-11	63.13
$CSAVE_{GDP}$	Current primary savings / Regional income		16.85	12.41	1.00 E-10	108.46
Institutional variables						
CAP	=1 if the region has transferred the responsibility for education and healthcare = 0 otherwise	By the authors	0.71	0.45	0	1
SPROV	=1 if the region comprises a single province: Asturias, Cantabria, La Rioja, Madrid, Balearic Islands and Murcia. = 0 otherwise		0.29	0.45	0	1
SING	= 0 for the Basque Country = 1 for Navarre = 2 otherwise		1.82	0.51	0	2
LIMIT	= 1 in 2002-11 = 0 otherwise		0.47	0.50	0	1
EXPLANATORY VARIABLES OF INEFFICIENCY						
Socioeconomic variables						
GDPpc	Per capita income of the region	INE	13,348.08	7,435.37	0	30,987.01
DENSITY	Population / km2		142.91	153.78	17.60	808.38
Budget variables						
TAX_{KE}	Tax revenue / Volume of capital expenditure	General Secretariat of Regional and Local Coordination (SGCHL)	2.23	2.64	0.05	25.68
FINEXP	(Interest + amortisation of the debt) / Current income		0.06	0.06	0	0.611
Political variables						
VOTES	% of votes obtained in the last election by the party in government	Ministry of the Interior	44.33	9.32	20.47	64.96
POLCOLOUR	= 1 if the party is left-wing = 0 otherwise	Ministry of the Interior	0.42	0.49	0	1
ELEC	=1 in an election year and the year before = 0 otherwise		0.52	0.50	0	1
Other hypotheses						
CRISIS	= 1 in the periods 1993-95 and 2008-11 = 0 in other periods		0.33	0.47	0	1
INSULA	= 1 in the Balearic Islands and Canary Islands = 0 in other regions		0.11	0.32	0	1

Source: By the authors.

The inputs used correspond to the three strategies the regions use to fund their investments. First, income from capital transfers expressed in terms of regional income

(IKT_{GDP}), as the government providing transferred capital funding can incentivise regional investment and generate a bandwagon effect on resources; although this can also produce the opposite effect, diverting funds towards current spending or lower taxes, or be lost along the way in unproductive practices, due to inefficiency. Second, the policies affecting current savings, as regions can practice austerity in their management of current spending freeing up funds for investment, and make a higher tax effort enabling them to finance more investments, or the complete opposite. Therefore, we have taken as input current savings in relation to regional income ($CSAVE_{GDP}$). And finally, annual income from borrowing, also measured in terms of regional income ($DEBT_{GDP}$). Here it should be borne in mind that Spain limited the use of borrowing to fund capital expenditure, stimulating capital expenditures over current expenditures, as well as consolidating intergenerational equity. But to strengthen financial solvency, in 2002 regional net indebtedness was prohibited, indirectly discouraging investment, as well as reducing the political benefits associated with the use of borrowing.

Table 2 shows that in Spain, the existing model for the distribution of the transfers tends to exclude, totally or partly, the territories with the highest levels of development, as it does not adequately consider the richest regions' need to finance new investment projects, nor the cost of replacement and obsolescence of their capital stock[6]. This has led them either to use current savings more intensively (as has happened in Murcia or regions such as Navarre, the Basque Country, Cantabria and the Balearic Islands, where income is usually above 75% of the European average), or to borrow more than the average (as in Aragon, Catalonia, and Valencia, with a notably low weight of current savings in the latter two regions). It also shows the increasing

[6] In Spain these transfers basically come from European structural funds (60%), the Inter-territorial Compensation Fund (25%), and agreements between administrations (15%). The first two of these are strongly oriented to redistribution.

importance of transfers (Bahl and Bird, 2013), given the limited tax capacity of sub-central governments and the growing restrictions on regional borrowing. This is weakening the exercise of political and fiscal responsibility by receiving governments, which eventually respond to the incentives introduced in the design of the transfers. In the current context, when European grants are decreasing, a well-designed distribution of the transfers is even more necessary.

Table 2: Relative weight of the financing sources of regional capital expenditure

(Averages in terms of GDP for the period 1995-2011)

	Capital expenditure	Sources of investment funding			
		Total	Income from capital transfers	Current savings	Net debt
Andalusia	2.65	3.52	1.35	1.59	0.58
Aragon	1.95	2.32	0.59	1.15	0.58
Asturias	3.12	3.41	1.27	1.70	0.45
Balearic Islands	1.59	1.93	0.31	1.23	0.39
Canary Islands	2.16	2.95	1.00	1.42	0.53
Cantabria	2.45	3.23	0.73	2.03	0.47
Castilla-La Mancha	3.53	3.70	1.37	1.76	0.57
Castilla-León	2.71	2.59	1.20	0.79	0.60
Catalonia	1.27	2.11	0.50	0.71	0.90
Valencian C.	1.44	2.12	0.41	0.95	0.76
Extremadura	4.22	4.84	2.36	1.90	0.58
Galicia	3.49	4.29	1.55	2.05	0.69
La Rioja	0.87	1.21	0.23	0.61	0.37
Madrid	1.92	2.40	0.75	1.14	0.50
Murcia	4.13	4.87	0.32	3.97	0.58
Navarre	1.65	2.69	0.27	2.00	0.42
Basque Country	2.16	2.74	0.48	1.74	0.53
Total	2.43	3.00	0.86	1.57	0.56

Source: By the authors, based on data provided by the Ministry of Finance and Public Administrations.

3.3 Results

The first block of Table 3, "Non-parametric models", shows the relative investment effort of the Spanish regions, calculated with *Stata*, for the total frontier (FDH) and for partial frontiers (Order-m and Order-α). The average execution level of investment potential ranges from 86% to 98%, depending on the technique used, and is closest to 100% with Order-α. This means that in general terms, the regional governments have few opportunities to increase their capital expenditure, given that they divert hardly any resources to other purposes. If we take into account that the regions must have some room to manoeuvre to finance current spending or maintenance associated with the subsidised investment projects, we could say that they are practically on the frontier. Such high levels of use of the possibilities offered by the sources funding their capital expenditure are in line with the results shown in the scanty literature on Spain. Using a conventional methodology (FGLS), Lago-Peña (2006) finds that in the period 1984-99, nearly 90% of capital transfers increase spending and the remaining 10% reduce the deficit (which would correspond to the fungibility effect). Fernández et al. (2013), using vector autoregressive models (VAR), also obtain similar results for transfers from the Inter-territorial Compensation Fund and the period 1990-2010.

Table 3 also shows that poor regions, such as Castilla-León, Castilla-La Mancha, Asturias, Galicia, and Extremadura, which receive large capital transfers (as seen in Table 3), divert hardly any resources from their intended investments. There are even indications that the opposite phenomenon could be occurring, with resources being dragged towards gross capital formation, given that the Order-α technique counts them as super-efficient decision-making units. This *bandwagon effect* could be capturing a true stimulus effect, in the sense that these regions use resources for investment which

should really be used for other purposes. This may be happening, for example, in Castilla-León, where the volume of capital expenditure exceeds the resources available for investment, as shown in Table 3. But given the methodology used by these techniques to construct the frontiers, it may also be indicating that the fungibility effect is absent, or hardly present. In other words, the diversion of resources which has become habitual, and which the legal framework permits up to certain limits[7], may not be happening, or at least not at the same scale, in the regions located beyond the frontier, as these resources are atypically allocated to financing capital expenditure.

This tendency to invest may be the result of the greater concern and interest of these regions in encouraging this type of action and fostering economic development, given their relatively disadvantaged situation. It may also be due to the quantitative weight of the transfers, which may occasionally lead them to overestimate returns on investment or distort the real situation so as not to lose the grants (Petchey and MacDonald, 2007). Another reason might be monetary illusion phenomena caused by transfer pricing, which must be controlled with mechanisms such as co-financing. But we must take into account that it could also be due to cost overruns, corruption, and inefficiencies which cause capital expenditure to rise sharply.

Madrid, the Balearic Islands and the Foral regions (the Basque Country and Navarre)[8] behave in a similar way. All of these, as prosperous regions, have very high investment efforts, which may be due to the capital city effect, in the case of Madrid; the island effect, in the Balearic Islands; and the special financing system of the Foral regions.

[7] However, the literature is full of cases where these limits are breached.

[8] Although for α = 0.95 only Navarre is super-efficient, and the other three regions (Basque Country, Madrid and Balearic Islands) are on the frontier, as α is reduced they acquire super-efficiency. Order-α is shown to be more sensitive than Order-m to the parameter value (α or *m)* used in each case, although the ranking of regions is found to be fairly robust, both to the technique and to the intrinsic parameter used.

Table 3: Situation of the regions in relation to their potential investment frontiers*

	Non-parametric models			Parametric model
	FDH	**Order-α**	**Order-m**	**SFA**
Andalucía (1)	0.78	0.93	0.74	0.93
Aragón (2)	0.78	0.86	0.78	0.71
Asturias (1)	0.93	1.07	0.92	0.92
Baleares (2)	0.91	0.93	0.94	0.49
Canarias (1)	0.79	0.92	0.76	0.67
Cantabria (1)	0.80	0.89	0.82	0.81
Castilla-León (1)	0.99	1.17	0.98	0.95
Castilla-La Mancha (1)	0.89	1.02	0.92	0.92
Catalonia (2)	0.66	0.69	0.66	0.79
C. Valenciana (1)	0.82	0.86	0.80	0.87
Extremadura (1)	0.96	1.25	0.94	0.95
Galicia (1)	0.87	1.09	0.89	0.95
Madrid (2)	1.00	1.00	1.00	0.97
Murcia (1)	0.74	0.81	0.72	0.91
Navarra (3)	0.99	1.25	0.98	0.95
Basque Country (3)	0.92	1.00	0.91	0.99
La Rioja (2)	0.81	0.88	0.83	0.77
AVERAGE	0.86	0.98	0.86	0.86
Poor regions (1)	0.86	1.00	0.85	0.89
Prosperous regions (2)	0.83	0.87	0.84	0.75
Foral regions (3)	0.95	1.13	0.94	0.97

(1), (2), and (3): classification of poor and prosperous regions (differentiating foral regions) based on European average income (Eurostat).

* Calculations for $\alpha = 0.95$ and $m = 300$, although the frontiers were calculated with different values for the parameters, in order to check the robustness of the results.

Source: By the authors.

The other regions are below the frontier, regardless of how it is constructed, revealing the presence of a clear *fungibility effect* for the resources obtained from conditional transfers, which is high in Murcia, Valencia, and Aragon, but above all in Catalonia, which given its available resources is the region showing the greatest improvement margin in its investment activity.

Thus, the results demonstrate a significant asymmetry in the behaviour of regional governments receiving conditional capital grants in terms of the investments made. This asymmetry is summarised in the last three rows of Table 3, which show how the investment ratios (actual/potential) are greater in poorer than in prosperous regions, regardless of the technique used, suggesting that the fungibility of resources is less present in poor regions. In some of them, the Order-m technique even suggests the opposite phenomenon, the *bandwagon effect*, as discussed above. This result contradicts Sagbas and Tolga (2008), who found a *fungibility effect* in poor Turkish provinces, and a *bandwagon effect* in rich ones.

4. The fungibility effect and its explanatory factors

4.1 Methodology and variables

Our study is completed by implementing the Stochastic Frontier Approach (SFA), an alternative methodology based on the stochastic frontier production possibilities suggested by Aigner et al. (1977) and Meeusen and van den Broeck (1977). This parametric technique lets us check and adjust the results obtained with the previous approaches and determine the explanatory factors behind the different levels of use of the investment potential (an aspect which has not been analysed until now in the available literature), estimating them simultaneously with the frontier investment. This can also be done with procedures associated with non-parametric techniques (Daraio and Simar, 2007), but a parametric approach, such as SFA, will enrich our analysis of investment, while allowing us to leverage the advantages and minimise the limitations of each method (non-parametric and stochastic), and to check the robustness of our previously obtained results.

SFA is increasingly popular internationally in empirical studies of public economy, based on the idea that no economic agent can be located beyond the frontier, so that any deviation from it can be considered as unused regional investment capacity, or *fungibility effect*. Therefore, this technique does not let us identify the bandwagon effect. However, it does let us see whether the hypotheses on the relationship between input (financing sources of capital expenditure) and output (potential investment) are significant, something which is particularly interesting in a study like ours. It also lets us incorporate *dummies* which capture the unique features of the institutions of each region (observed heterogeneity), which can influence their investment potential, and which we cannot consider with non-parametric techniques. Also, with the SFA we can see the causes of the *fungibility effect*.

The stochastic frontier technique is implemented statistically through the specification of a regression model with two error terms, which for investment is represented as:

$$ln\ KE_{GDPit} = \beta_0 + \Sigma_R\ \beta_R\ ln\ x_{Rit} + \Sigma_H\ \beta_H\ ln\ y_{Hit} + v_{it} - u_{it} \qquad [1]$$

where KE_{GDPit} is investment in terms of the region's income *i* in year *t*, with $i = 1, 2, \ldots, 17$ and $t = 1991, \ldots, 2011$; β_0 is the common constant for all the regions in the year *t;* β_R and β_H are parameter vectors to be estimated; x_{Rit} would be the three sources of funding for investment in the region *i* in the year *t*: IKT_{GDP}, $CSAVE_{GDP}$ and $DEBT_{GDP}$, which are measured as explained above; and finally, y_{Hit} should capture the unique features of the institutions of each region, which can cause heterogeneity in the sample on the frontier. These last would be, first, a *dummy* variable (CAP) to reflect the uneven level of responsibility of the regions, according to whether they are responsible for education and healthcare, as these involve a greater volume of capital expenditure.

Second, a *dummy* identifying the single-province regions (*SPROV*), as these absorbed their respective Provincial Governments, assuming their responsibilities, and therefore their obligations in terms of investment projects[9]. Third, a qualitative variable to capture the unique financing systems of the Basque Country and Navarre (*SING*), which give them greater autonomy in tax matters. And finally, a qualitative variable (*LIMIT*) for the budget balancing rule introduced in 2002, which reduced investment potential significantly by eliminating a source of self-financing: borrowing.

The error term v_{it} in equation [1] represents the usual statistical noise - in other words, everything outside regional control (such as stochastic disturbances and random shocks, measurement errors, etc.). The second error term, u_{it}, represents the distance to the investment potential or fungibility effect, given certain inputs (financial resources and institutional variables), and would be the function of variables, z_{it}, which may change over time.

$$u_{it} = \delta z_{it} + w_{it}, \qquad [2]$$

where δ is a coefficient vector to be estimated and w_{it} is the error term.

The variables, z_{it}, which we have considered may influence the fungibility of resources, *u*, are grouped in five blocks. First, *socioeconomic variables* such as per capita income (*GDPpc*) and the population density of the region (DENSITY), although to capture decreasing returns or congestion costs we have also included density squared ($DENSITY^2$). Second, two *budget variables*. On one hand, the regional tax revenues in relation to the volume of capital expenditure (TAX_{KE}), intended to capture the political costs of using tax as a source of funding, which could make the regional government want to meet its own spending targets, diverting resources to other purposes. And on the

[9] In contrast, the regions with more than one province maintained the Provincial Governments, which are configured as an intermediate level of government between the region and its municipalities.

other, the importance of financial expenditure in current income (*FINEXP*), insofar as it reflects the financial risk assigned by the credit market, being therefore an indicator of capacity to co-finance new capital expenditure (Herrero-Alcalde et al., 2011). Third, we have taken into account various *political matters* which could affect the degree of control exercised by the regional government: the political colour of the governing party (*POLCOLOUR*), the existing level of political competition (*VOTES*)[10], and a variable identifying the election and pre-election year (*ELEC*) to test the electoral cycle thesis. Fourth, we incorporated a qualitative variable (CRISIS) identifying the periods of economic crisis (1993-95 and 2008-11), in order to see whether capital expenditure is significantly reduced in these years, given its non-mandatory nature. And finally, given the unique features of the two archipelagos, we have incorporated a qualitative variable (INSULA) to capture their potentially different behaviour.

4.2 Results

In light of the methodology and hypotheses discussed above, we have estimated with panel data (1991-2011), and in a single stage, equations [3] and [4] of the stochastic investment frontier model, with random effects, proposed by Greene (2005) and Belotti et al. (2012)[11], shown below:

$$KE_{GDP} = f\,(IKT_{GDP}, DEBT_{GDP}, CSAVE_{GDP}, CAP, SPROV, SING, LIMIT) + v - u \qquad [3]$$

$$u = g\,(GDPpc, DENSITY, DENSITY^2, TAX_{KE}, FINEXP, VOTES, POLCOLOUR, ELEC, CRISIS, INSULA) \qquad [4]$$

[10] We constructed the variable as a percentage of votes obtained, expecting that the lower the competition and its control over the governing party, the greater the investment effort (the Leviathan hypothesis).

[11] In the true random effects model (TRE), the regions share the constant term of the specification. Although Farsi, Filippini and Kuenzle (2007) point out that TRE models yield the most plausible estimations of efficiency, we also tested the fixed effects approach of Greene (2005), in which the constant term is different for each region, with the model giving similar results.

This estimation considers that inefficiency may vary over time, and the term inefficient excludes unobserved heterogeneity which does not change over time. The results, shown in Table 4, indicate the suitability of the SFA as a method for estimating the *fungibility effect*. Specifically, as the estimator λ is significant in the model, the null hypothesis that γ equals 0 is rejected, which confirms the suitability of the SFA as method of study in this case, i.e. the need to include the *fungibility effect*, *u,* in the investment capacity function, which should not be approximated using an estimated average behaviour function (OLS). Additionally, the significant value of θ suggests that unobserved heterogeneity of the regions must be separated from the inefficiency effects, which validates the Greene (2005) approaches we use[12]. Meanwhile, the significance of the variables explaining the degree to which the investment potential is not used or *fungibility effect*, validates the suggested equation.

The estimation indicates that the explanation of the investment potential of regional governments rests on a combination of the theses discussed above. Specifically, the model suggests that income from capital transfers (IKT_{GDP}) is the financing source which makes most regional investment possible, with borrowing ($DEBT_{GDP}$) and current savings ($CSAVE_{GDP}$) being less important[13]. We also observe that when a regional government resorts to citizens' income through borrowing or current savings, it presents a very low marginal propensity to invest (around 7%), compared to the result of financing with subsidies (25%), which may indicate the presence of a fiscal illusion problem connected to the *flypaper effect*.

[12] See Farsi, Filippini and Greene (2006).

[13] Similar results are found by Fernández et al. (2013).

Table 4: Results of the stochastic frontier analysis of investment

Variable	Coefficient	z-statistics
Frontier model		
$LIKT_{GDP}$	0.25661**	13.18
$LDEBT_{GDP}$	0.07476**	5.71
$LCSAVE_{GDP}$	0.06911**	4.01
SING	0.41162**	7.49
CAP	0.12736**	4.83
SPROV	0.11549**	2.57
LIMIT	-0.01684**	-5.16
CONS	1.590829**	15.25
Inefficiency		
GDPpc	0.001048*	2.00
DENSITY	-0.0041849**	-4.27
$DENSITY^2$	1.3e-06	1.10
TAX_{KE}	0.1307379**	11.18
FINEXP	2.076081**	6.56
POLCOLOUR	-0.922829*	-2.25
VOTES	-0.0105506**	-3.93
ELEC	-0.218227*	-2.15
CRISIS	-0.736958*	-2.35
INSULA	0.9672978**	7.82
CONS	0.424772*	2.19
λ (Ho: γ =0)	0.638746**	19.57
σ_u^2	0.0888998**	3.48
σ_v^2	0.1391785**	14.93
$\gamma = \sigma_u^2/\sigma_\varepsilon^2$	0.6387468**	19.57
θ	0.5411886**	14.09

(**) Significance at 1% and (*) at 5%.
Source: By the authors.

The institutional variables are also key to explaining the investment potential, and as we expected, both the level of responsibility (*CAP*) and being a single-province region (*SPROV*) have a close and direct relationship with potential capital expenditure. Also, regions with a common financing regime may invest more than foral regions (*SING*),

which probably responds to the design of the transfer system (based on the criteria of equity) and the quantitative importance of European structural funds, which exclude the foral territories due to their high per capita income. Alongside this, the incorporation of the budget balancing law from 2002 (LIMIT) had the effect of reducing investment potential, as expected.

All the factors considered in the estimation of the unused investment potential or *fungibility effect* are also significant and have the expected sign. On one hand, the results indicate that the diversion of resources is directly associated with the region's income level (*GDPpc*), as indicated by the non-parametric techniques in the previous section. The reader will recall that these showed that the richer regions divert more resources than the poorer regions. This may mean that regional development policies are effective and facilitate investment in the least favoured regions, while the wealthiest regions opt to prioritise current spending in response to a growing demand for public services from their higher-income citizens. This result would also confirm the hypothesis that opportunity costs for citizens in the most prosperous regions involve less control over government spending. On the other hand, density (*DENSITY*), which is an indicator of relative need for investment and differential costs (scale economies), shows that the most dynamic regions, where the population tends to concentrate, divert fewer resources, without any sign of decreasing returns in the management of capital public services or congestion costs ($DENSITY^2$). This aspect is considered in the design of Spanish regional development policy, as an element determining the distribution of the transfers by the central government.

The two budget variables we have used also stimulate the *fungibility effect*. The significance of the tax variable (TAX_{KE}) suggests that the political cost of tax collection makes governments prefer to meet their own spending targets, diverting resources to

other purposes (according to theoretical hypotheses, this result suggests a price elasticity of capital expenditure less than 1). And greater financial expenditure (*FINEXP*), making it difficult to obtain financing due to higher credit risk, means less capacity to co-finance investment projects, some of which may remain unrealised, with the resources being diverted to other purposes (financial or current spending).

The model also reveals that political factors explain the *fungibility effect*. Specifically, it shows that majority governments (*VOTES*) divert few resources from their intended investments, as the absence of political competition hinders the approval of unwanted capital projects; and that in election and pre-election years (*ELEC*) there is less diversion of resources, as the government seeks the political benefits of the investments (Bahl and Bird, 2013). We have also found different investment behaviour according to the ideology of the governing party, with left-wing governments diverting the fewest resources (*POLCOLOUR*).

The significance of the CRISIS variable reveals the cyclical behaviour of the *fungibility effect*. Despite the role of investment as an adjustment variable in times of austerity (Allain-Dupré, 2011), given that capital projects are a type of spending that is not committed to ahead of time (compared to current and financial expenditure), the model shows that during the periods of economic crisis or budget stress, the gap between potential and actual investment is smaller. This is probably due to the stabilising role of investments attributed to income transferred from the central government, but also to the shrinkage of potential investment in times of crisis, due to greater budget restrictions.

Finally, despite the special treatment of the archipelagos in development policy, the model shows that the geographical and economic disadvantages of being an island favour the *fungibility effect*[14].

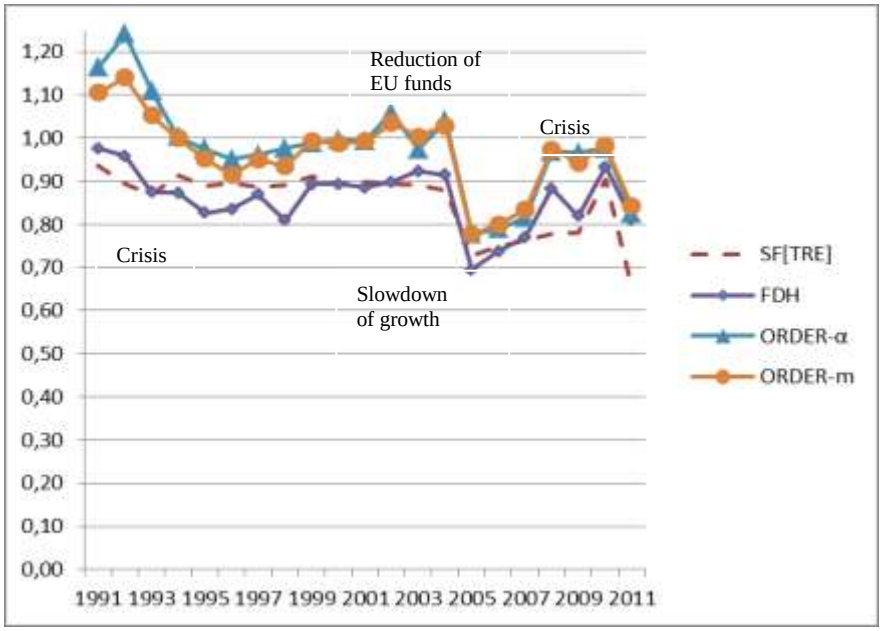
Knowing the hypotheses determining the investment potential of a region and the factors influencing the diversion of resources to purposes other than capital expenditure, we have calculated the degree to which each region really uses its potential investment capacity. The margin between each one and the frontier will therefore be the *fungibility effect* we want to measure. The results obtained with the stochastic frontier method, displayed in the right-hand column of Table 3, show a high degree of use of the investment potential of the regions, at an average of 86%. Thus, the Spanish regions divert an average of 14% of the resources they obtain for investment purposes, with the poorest regions diverting the fewest resources. This asymmetry in the allocation of the transfers is in line with the non-parametric methods, contributing to the robustness of the results. One might think that an asymmetrical behaviour of this type, continuing over time, would contribute to reducing the existing gap between both types of regions, bringing their respective stocks of capital closer together.

The evolution over time of the executed/potential investment ratio, displayed in Figure 1, also shows a very similar pattern, regardless of the estimation technique used. The high point of this evolution was the heavy investment effort made in the early 1990s, at the time of the Seville Expo and the Barcelona Olympics, at a level which has not been repeated. In fact, the *fungibility effect* was especially intense in the following "hangover" years, although it must also be remembered that this was a period of

[14] We have also tested other variables. We tested different definitions of the SING variable, which we include to explain the investment potential of the region. To explain the *fungibility effect*, we also tested the weight of the agricultural sector in national income, and population, as alternative socioeconomic variables, as well as a variable identifying the regions governed by nationalist/separatist parties, and another which captures whether the party in the regional government is the same as the national governing party. However, they all produced less satisfactory results.

intensive adjustment prior to Spain's entry into the European Economic and Monetary Union. Another notable year is 2005, for the shock of the sudden drop in EU funds due to the Union's expansion to 25 member states, which led to a drastic reduction in the execution of capital expenditure in many Spanish regions, with a much higher diversion of resources to other purposes[15]. Finally, it will be observed that the current crisis, the full scope and effective impact of which is still unknown, has obliged the Spanish regions to change their investment effort, increase their tax pressure or reduce the resources assigned to other budget items, but it is also true that it has probably incentivised improved management and a more efficient allocation of resources. Indeed, it has very possibly caused a combination of all these strategies.

Figure 1: Changes in regional investment over time



[15] There are several explanations to be found for this cyclical behaviour. On one hand, a smaller volume of transfers reduces the financial illusion, and therefore the costs of certain investment projects are not undervalued, so that a conservative outlook would lead to a rejection of investments of marginal importance in order to adapt to the new framework. On the other, a reduction in transfers reduces the *crowding in* effect or the attraction of private investment, which is co-financer along with public grants, so this was another way in which the least profitable investment projects were abandoned. It must also be taken into account that although the financing system of the regions offers them the possibility of obtaining more resources through their regulatory powers over certain taxes, the unpopularity of these measures usually leads them to use this legal capacity to reduce taxes, so that hardly any income is obtained in this way.

5. Conclusions

Donor governments providing conditional grants reveal their concern that the regions receiving the grants may divert these resources to purposes other than investment (*fungibility effect*): reducing tax collection, debt or the current deficit; increasing current spending; and even losing them along the way due to poor management. For this reason, donor governments are designing their programmes of conditional capital subsidies to stimulate investment in the region receiving the grants, while incentivising the incorporation of additional resources to capital formation by the receiving government. For this reason, this work tries to quantify the *fungibility* or *bandwagon effect* caused by conditional capital transfers in the behaviour of the Spanish regions, using various frontier techniques.

Both the non-parametric techniques and the stochastic frontier analysis show a *fungibility effect*, which is present especially in the most prosperous regions. However, only non-parametric partial frontier techniques, which let regions be located beyond the frontier, can technically identify a *bandwagon effect* which drags resources towards investment, which is localised in some poorer regions. This asymmetry in investment behaviour may reflect the pattern of redistribution incorporated in the design of capital transfers, and the interest or preference of poor regions for this type of activity as a factor of development and economic growth. The average *fungibility effect* in Spanish regions can be established at 2% - 14%, although many regions clearly have a greater margin for manoeuvre to increase investment effort.

The results of our analysis also show that the *fungibility effect* depends directly on regional income, the budget variables, and insularity; and it relates inversely to population density, the number of votes, being involved in an election campaign, or a

left-wing party being in power. In temporal terms, the model shows that for the Spanish regions, periods of economic crisis notably reduce the *fungibility effect*.

To conclude, it should be noted that there are at least two worrying situations or challenges to be faced. On one hand, the gradual reduction in European funds and the reaction of the regions which depend on them most heavily (such as Extremadura, Castilla-La Mancha, Castilla and León, and Valencia), together with much tougher restrictions on borrowing. On the other, the situation in regions with congested capital goods or specific deficits hampering their long-term prospects for economic growth (such as the Balearic Islands, Catalonia, Madrid, and Aragon). Therefore, to ensure the continuity of the process of growth and internal convergence, it would be recommendable to consider a reform of the funding system which would guarantee a greater level of financial autonomy, enabling regions to obtain sufficient additional resources to co-finance the subsidised projects, and complementing the centralised development policy, adapting it to the different preferences of the territories (Petchey and MacDonald, 2007), without having to take resources from other purposes (*bandwagon effect*) nor divert them from their intended uses (*fungibility effect*). This would make it possible to attend to the needs both of lower-income regions, and of wealthier regions whose growth is limited by congestion or a scarcity of strategic capital goods, such as infrastructure, other public equipment, or spending on R&D.

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APPENDIX

Table 1.A: Correlation matrix of variables

	KE_{GDP}	IKT_{GDP}	$DEBT_{GDP}$	$CSAVE_{GDP}$	CAP	SPROV	SING	LIMIT	GDPpc	DENSITY	TAX_{KE}	FINEXP	POLCOLOUR	VOTES	CRISIS	ELEC	INSULA
KE_{GDP}	1.00																
IKT_{GDP}	0.74	1.00															
$DEBT_{GDP}$	0.12	0.08	1.00														
$CSAVE_{GDP}$	0.45	0.25	-0.28	1.00													
CAP	-0.04	-0.12	0.18	0.11	1.00												
SPROV	-0.18	-0.18	-0.17	-0.05	-0.15	1.00											
SING	-0.03	0.34	-0.13	-0.20	-0.18	0.16	1.00										
LIMIT	-0.21	-0.29	0.21	-0.10	0.24	-0.02	-0.21	1.00									
GDPpc	-0.54	-0.67	-0.17	-0.02	0.40	0.17	-0.16	0.26	1.00								
DENSITY	-0.64	-0.61	-0.08	-0.28	0.06	0.32	-0.15	0.15	0.42	1.00							
TAX_{KE}	-0.61	-0.50	0.01	-0.20	0.38	0.14	0.09	0.47	0.54	0.44	1.00						
FINEXP	-0.19	-0.03	0.14	-0.22	-0.50	0.15	0.08	-0.16	-0.24	0.08	-0.21	1.00					
POLCOLOUR	0.18	0.30	0.11	-0.01	-0.11	-0.17	0.15	-0.05	-0.28	-0.23	-0.12	0.02	1.00				
VOTES	0.07	0.18	-0.11	-0.06	-0.11	-0.02	0.33	0.05	-0.17	-0.03	0.04	0.00	-0.07	1.00			
CRISIS	-0.17	-0.28	0.27	-0.15	0.14	-0.04	-0.25	0.92	0.19	0.09	0.37	-0.07	-0.04	-0.02	1.00		
ELEC	-0.02	-0.05	-0.05	-0.04	0.05	0.00	-0.04	0.10	0.01	0.00	0.09	-0.03	-0.01	-0.03	0.13	1.00	
INSULA	-0.12	-0.13	-0.15	0.00	0.03	-0.22	0.10	-0.10	0.18	0.13	0.09	-0.11	-0.12	-0.25	-0.06	-0.01	1.00

Source: By the authors.