Political parties, two- level Governance and economic growth

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Abstract

We test the effect of different combinations of parties ruling the central and regional governments on regional economic growth. If such an effect exists, it should accrue through the total factor productivity (TFP). Using panel data regression for the Spanish regions over the 1989-2004 period with TFP growth rate as an endogenous variable, we find no effect. We go further and propose a simultaneous two-equation model with the growth rates of TFP and public infrastructure as endogenous variables, finding indirect effects of some combinations of parties on TFP through the provision of public infrastructure. The main finding is that in central left-wing governments without a majority, a positive indirect effect arises in self-governed regions. However,

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when central left-wing governments have a majority, negative indirect

effects arise in regions governed by regional parties. Our results are

robust to different methods of estimations and measures of TFP.

1   Introduction

In a country with multiple governance levels, the involved governments are responsible for the effective connection and good performance of their institutions, which can be defined as rules and organs that drive the production atmosphere and are supposed to influence factor productivities. Evidence relating quality of institutions and economic growth can be found in Hall and Jones (1999)[1] and Rodrick *et al.* (2004), among others. In their approach, the quality of institutions is measured by an indicator that accounts for the role of the government in law, order and property rights protection, as well as capturing bureaucracy, corruption, risk of expropriation and government repudiation of contracts quality. Their results stress that one of the main factors explaining the poor performance of developing countries is the quality of institutions, while developed countries enjoy consolidated institutions.

Unlike the above authors, we address another question. We consider a developed country assumed to have qualified institutions as defined by these authors and focus on political institutions. Defined in broad terms, political institutions include political parties, electoral rules and governance levels. Specifically, we are interested in analyzing the effects that combinations of parties ruling different levels of government could have on regional economic growth. We consider a federalist country at two levels of governance, each of

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[1]Hall and Jones use social infrastructure defined as institutions and government policies that determine the economic environment within which individuals accumulate skills and firms accumulate capital and produce output.

which is characterized by a parliamentary system (central and the regional parliaments) and whose representatives are elected democratically through electoral processes. Which party governs depends on the composition of the parliament. Thus, when there are at least two parties, mixed governance (i.e. different parties governing at each level of government) is practically ensured in at least one region.

Our work could be framed in the literature on Partisan Theory which states that political parties have different preferences over macroeconomic goals. The seminal work of Hibbs (1977) showed that in Western European and North American nations, left-wing governments are more concerned with low unemployment, while right-wing governments are more concerned with low inflation. Alesina (1987) and Alesina and Sachs (1988) confirm Hibbs' results for the US case. Using data on OECD countries, Alesina and Roubini (1992) found that in the short run (about two years) left-wing governments expand the economy when elected. However, no support for permanent effects on real economy was found. MidtbØ (1999) found that left-wing governments in the United States, Britain and Canada have reinforced the growth of both public spending and GNP. Recently, Pettersson-Lidbom (2008) found for Sweden that left-wing governments lower the unemployment rate by increasing public employment and spending and taxing more than right-wing governments. Therefore, the empirical evidence reveals that the higher economic growth under left-wing governments is associated to higher public

spending.

We go further as we are interested in testing whether ideological combinations at the different levels of government could have an effect on the economic growth of regions in a particular country. Differences in time might arise in the relationships between the two levels of government involved due to commitments, arrangements or disagreements. Specifically with mixed governance, disagreements about certain projects are more likely to arise as a result of the different points of view, political objectives and priorities of each political party. In fact, individual regional aspirations, major infrastructure projects or even environmental laws and the justice administration could depend on the combinations of parties in the central and regional governments. However, mixed governance has the advantage that it may function as a useful mechanism to prevent arbitrariness.

Our goal is interesting not only at the regional level, but also at the European level due to the resurgence of regional policy to reduce disparities between European regions.[2] Given that, as far as we know, studies assessing the impact of mixed governance on economic growth are inexistent in the literature, our aim is to open a path with the purpose of filling this vacuum. Our results could be interpreted as a measure of consensus between different levels of government, i.e. among parties and their effects on the economy.

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[2] The regional policy of the European Union seeks to promote the reduction of structural differences between the regions of the EU, the balanced development of the community and to ensure equal opportunities for all people.

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In this paper, we consider the Spanish case at two levels of government: the central level and the regional level. We focus on part of the democratic period and all the autonomous communities of Spain.[3] During the period in question, we basically find three kinds of parties which we have classified as right, left and regional.

To achieve this aim, we perform a growth accounting exercise at the regional level to analyze the factors that explain economic growth across regions and to obtain the evolution of total factor productivity (TFP). We assume that the effect of political institutions on economic growth accrues through TFP. Hence, this is the endogenous variable in our analysis, and for which we have specified a particular function form to perform econometric estimations.

Firstly, in our empirical estimations, we rely on panel data regression controlling for individual effects, economic structure of the regions, a health-care indicator and public infrastructure. Dummy variables are introduced to capture combinations of parties ruling the different levels of government.

Our first results show that $i)$ none of the combinations of parties at either level of government has an effect on the TFP growth rate, $ii)$ the growth rate of public infrastructure does have a significant positive effect on the TFP growth rate, in line with Aschauer (1989) for the US case.

Secondly, we hypothesize that the provision of infrastructure could also be

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[3]Autonomous communities refers to a set of territories that do not all share the same characteristics. Some have a more developed level of political decision-making than others.

affected by political arrangements, disagreements or commitments between the regional and central governments. Therefore, we estimate a simultaneous two-equation model with the variables TFP growth rate and public infrastructure growth rate as endogenous variables. Again, we find no effect of the combinations of parties on TFP growth rate. However, we do find a positive effect of the growth rate of public infrastructure on the growth rate of TFP. Moreover, *iii)* significant effects of some combinations of parties on the growth rate of public infrastructure were found. Therefore, we claim that combinations of parties in the different levels of government have indirect effects on TFP through the provision of public infrastructure. Specifically, our main finding is that when the left party is in both levels of governments, but does not hold a majority in the central government, there is a significant positive effect on public infrastructure in self-governed regions. However, when it does hold a majority, negative effects are found in regions governed by regional parties. Therefore, doubts arise about the consolidation of political institutions in Spain.

Our results are robust to different methods of estimation and measures of TFP.

The article is organized as follows. An overview of the Spanish political system is presented in the following section. The growth accounting exercise is shown in section 3. The econometric model and estimations are described in section 4, while conclusions are drawn in section 5.

2 An Overview of the Spanish Political System

Governance levels: Administrative Divisions

(i) *Central Government*

Spain, or the Kingdom of Spain, has a constitutional monarchy with a hereditary monarch and a bicameral parliament known as the *Cortes Generales*. The executive branch consists of a Council of Ministers presided over by the President of the Government (comparable to a prime minister), who is elected by National Assembly legislative elections and proposed by the monarch. The Constitution of 1978 sets up the framework by which the country evolves and explicitly states the indivisible unity of the Spanish nation.

The Spanish nation is structured into what is known as the *Estado de las Autonomías* (State of Autonomies), thus creating a unique system of regional autonomy. Spain is one of the most decentralized countries in Europe, alongside Switzerland, Germany and Belgium.

(ii) *Autonomous communities*

An autonomous community is the first-level political division of the Kingdom of Spain as established under the Spanish Constitution of 1978; which culminated the Spanish transition to democracy. As a result, Spain presently

comprises 17 autonomous communities and two autonomous cities with varying degrees of autonomy.

The autonomous communities enjoy broad legislative and executive autonomy through their own parliaments and regional governments. The distribution of powers may vary in each community as laid out in the basic institutional law on autonomous communities, the *Estatuto de las Autonomías* (Statutes of Autonomy). All autonomous communities have their own elected parliaments, governments, public administrations, budgets and resources. As a result, their health and education systems, among others, are managed regionally. Furthermore, some communities also retain their economic and fiscal autonomy based on foral provisions allowing them to manage their own public finances and have their own full-range police forces which replace some of the functions of the state police corps. This assignation of functions at the regional level is known as the *Concierto Económico*.

The autonomous communities of Spain are[4] Andalusia, Aragon, the Principality of Asturias, the Balearic Islands, the Basque Country, the Canary Islands, Cantabria, Castile-La Mancha, Castile and Leon, Catalonia, Extremadura, Galicia, La Rioja, Madrid, Murcia, Navarre and Valencia.

(iii) *Provinces and Municipalities*

The Spanish Constitution recognizes, grants and protects two subdivi-

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[4]Between 1979 and 1983, all the regions of Spain were established as autonomous communities. The process concluded in 1996 when Ceuta and Melilla gained autonomous status, but these last two cities are not considered in our study.

sions within the autonomous communities of Spain. As such, the provincias (provinces) serve as the local territorial building blocks for the former (the framework under which the autonomous communities were created). In turn, the provinces are divided into municipios (municipalities). Municipalities are granted autonomy to manage their internal affairs, while provinces are the territorial divisions designed to carry out the activities of the state.

Today, Spain is divided into 52 provinces and 8111 municipalities. A province is a self-governing territory, which is led by a provincial council in communities with more than one province. Provincial councils have no legislative authority, but exercise certain executive functions. On the other hand, municipalities are the basic level of local government in Spain. The governance of municipalities is the responsibility of city councils, whose highest authority is the mayor. The functions carried out by these local bodies are considered to be in closest proximity to citizens.

In sum, each municipality forms part of a province, which in turn forms a part or the whole of an autonomous community.

Political System

Spain's political system resembles a two-party system insofar as there are two dominant political parties, making it relatively difficult for political representatives to achieve electoral success under the banner of any other party. However, regional or nationalist parties can have a stronghold in autonomous

communities such as Catalonia and the Basque Country and are essential for government coalitions or parliamentary majorities, thus transforming Spain's two-party system into a multi-party system.

An example of Spain's political parties include i) National parties in the Cortes Generales: Spanish Socialist Workers' Party (Partido Socialista Obrero Español or PSOE), which includes its regional representatives in Catalonia (PSC), the Basque Country (PSE) and Valencia (PSPV); People's Party (Partido Popular or PP) including its regional representative in Navarre (UPN); United Left (Izquierda Unida or IU) with its regional representatives in Catalonia (EUiA) and the Basque Country (EB) and ii) Regional parties in the Cortes Generales: Convergence and Union (Convergència i Unió or CiU); Basque Nationalist Party (PNV), Galician Nationalist Bloc (BNG), Chunta Aragonesista (CHA) and Canarian Coalition (CC).

Electoral Processes

General and regional elections are typically held at four-year intervals with some exceptions. In our sample period general elections were held in 1989, 1993, 1996, 2000 and 2004. Regional elections took place in Aragon, Asturias, the Balearic Islands, the Canary Islands, Cantabria, Castile-La Mancha, Castile-Leon, Valencia, Extremadura, La Rioja, Madrid, Murcia and Navarre on the same day in 1991, 1995, 1999 and 2003. Andalusia held elections in 1990, 1994, 1996, 2000 and 2004; the Basque Country in 1990,

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1994, 1998 and 2002; Galicia in 1989, 1993, 1997 and 2001; and Catalonia in 1988, 1992, 1995, 1999 and 2003. The particular features of the Spanish electoral and party system mean that the elections held at each layer of government depend on the other layers. Thus, parties have a special interest in the results of regional elections since they provide an opportunity to test the real prospects of a given party. Indeed, campaign efforts could drive a party to use the various posts it controls at different layers of government to allocate resources in order to pursue its electoral objectives. The high degree of partisan control facilitates the use of resources coming from different posts to achieve party interests.

3 Growth Accounting

In this section a growth accounting exercise for the 1988-2004 period is used with a twofold objective: to estimate the evolution of TFP in the Spanish regions and to analyze the factors that explain the long-run growth experience.

We consider the standard assumptions about technology represented by an aggregate Cobb-Douglas production function and about input markets, capital and labor, which are given by perfect competition. The representative region i shows the following production function at each period t

$$Y_{it} = A_{it} K_{it}^{\alpha_{it}} L_{it}^{1-\alpha_{it}}$$

The final aggregate output, Y_{it}, denotes the gross added value in region i

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during period t provided by the National Statistics Institute of Spain (INE). K_{it} is stock of non-residential productive physical capital in region i during period t based on statistics provided by the BBVA Foundation and the Economic Research Institute of Valencia (IVIE).[5] L_{it} is the number of employees in region i during period t according to statistics of the Bancaja Foundation and IVIE, and A_{it} is a measure of the total factor productivity (TFP).[6]

Moreover, we assume a specific aggregate production function with labor adjusted for human capital as:

$$Y_{it} = B_{it} K_{it}^{\alpha_{it}} N_{it}^{1-\alpha_{it}},$$

where B_{it} is the TFP when labor is adjusted for human capital and N_{it} denotes the amount of human capital-augmented labor used in production whose specification is an extension of Halls and Jones (1999),

$$N_{it} = \sum_{j=0}^{4} L_{it,j} e^{\phi_j x_j},$$

where $j = 0, 1, 2, 3, 4$ is levels of education, x_j is years of each educational level[7] and ϕ_j is the rate of return to schooling (known as the Mincer index, 1974) from Lassibille and Navarro (1998).

Regarding the choice of labor share series, $1 - \alpha_{it}$, for the autonomous communities of Spain, we do not only consider the published series of wages

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[5]The Y_{it} and K_{it} series are referred to in constant euros with base year 2000.

[6]A_{it} is a good approximation to the neutral technical progress using growth accounting in a non-parametric context.

[7]We assume the middle point of each range of years of schooling, which are assumed to be equal for all regions and constant over time.

because they might be underestimated if they are not adjusted to include self-employed and family workers. We use the measure proposed by María-Dolores and Puigcerver (2005) in order to correct for this bias.[8]

Given our choice of series for output Y_{it}, labor L_{it}, productive physical capital K_{it}, capital share α_{it}, years of schooling x_j and rate of return to schooling ϕ_j, we calculate the growth rate of TFP through the Divisia-Tornqvist index as follows,

$$\Delta Log\left(B_{it}\right) = \Delta Log\left(Y_{it}\right) - \Delta Log\left(KN_{it}\right)$$

where

$$\Delta Log\left(KN_{it}\right) = \frac{\alpha_{it} + \alpha_{it-1}}{2}\Delta Log\left(K_{it}\right) + \frac{\left(1 - \alpha_{it}\right) + \left(1 - \alpha_{it-1}\right)}{2}\Delta Log\left(N_{it}\right)$$

and Δ is the incremental operator, the log differentials are growth rates.

In order to perform a growth accounting exercise for the i Spanish region and given that Y_{it} is homogenous of degree one with respect to the factors, the production function can be expressed in per worker terms as,

$$y_{it} = B_{it}\left(k_{it}\right)^{\alpha}\left(h_{it}\right)^{1-\alpha},$$

where $y_{it} = Y_{it}/L_{it}$ is output per worker, $k_{it} = K_{it}/L_{it}$ is physical capital per worker and $h_{it} = \frac{N_t}{L_t}$ is human capital per worker.

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[8]This measure takes into account the value of labor income referred to as "mixed income".

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This specification allows us to decompose differences in output per worker across regions in Spain over period t to $t+s$ in the contribution of the changes in TFP, physical capital per worker and human capital per worker,[9]

$$\frac{(Log\,(y_{it+s}) - Log\,(y_{it}))}{s} = \frac{(Log\,(B_{it+s}) - Log\,(B_{it}))}{s} + \left(\frac{\alpha_{it+s} + \alpha_{it}}{2}\right)\frac{(Log\,(k_{it+s}) - Log\,(k_{it}))}{s} + \left(\frac{(1 - \alpha_{it+s}) + (1 - \alpha_{it})}{2}\right)\frac{(Log\,(h_{it+s}) - Log\,(h_{it}))}{s}$$

Table 1 shows the results of a standard growth accounting exercise performed for the Spanish economy for the 1988-2004 period, as well as for two specific subperiods: left-wing government, 1988-1996; and right-wing government, 1996-2004. These results give rise to two particular features about sources of growth which differ from other works on Spanish regions since physical capital refers to productive capital and the labor factor is a measure adjusted for human capital. In general in the overall period, the Spanish growth experience of output per worker was chiefly due to changes in the physical capital, k_{it}, rather than to changes in the total factor productivity, B_{it}.[10] By period, it is interesting to note the better economic behavior

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[9]We performed another growth accounting exercise following Hayashi and Prescott (2002) who specified the capital-output ratio rather than the capital-labor ratio. The results of our exercise do not change significantly. However, they are not shown since our interest is not to measure the contribution of deviations from balanced growth behavior. They are available upon request.

[10]These results are in line with the literature on growth regarding the definition of balanced growth path and deviations from this path. According to this definition, changes

of left-wing governments which have an annual output per worker growth rate of 1.52 percent, in contrast to right-wing governments, which is 0.07 percent. Notice that although the annual growth rates of inputs are positive, they are higher in left-wing governments and changes in TFP are more negative in right-wing governments, i.e. in the earlier period there was significantly more physical and human capital accumulation. In particular, the 1.62 percent change in human capital over the 1988-1996 period explains the economic behavior more accurately than the 1.08 percent change in physical capital. In the 1996-2004 period, the growth of output per worker is chiefly accounted for by changes in physical capital of 0.28 percent.

A regional-level picture is drawn in Figure 1. All the Spanish regions show positive average annual growth rates of productivity and negative average annual growth rates of TFP during the period under consideration. Physical and human capital increased at positive rates, with a greater increase found in labor adjusted for human capital.

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in factors other than TFP are important in accounting for growth (see Kehoe and Prescott, 2002)

Figure 1
Growth Accounting (period 1988-2004)
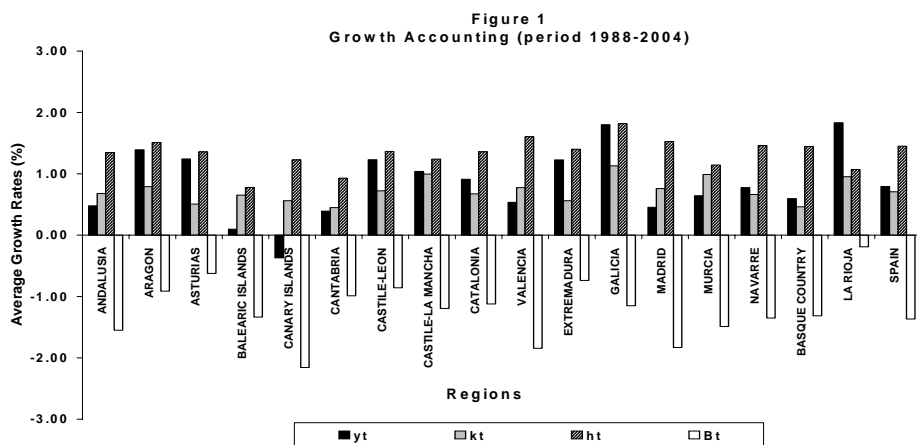
4 Econometric Estimations

4.1 Benchmark Model

Let us specify a function for the TFP of region i in time t as

$$B_{it} = B_{it-1} f\left(\delta_i, SI_{it}, hc_{it}, k_{it}^{pu}, D_{it}, \varepsilon_{it}\right) \qquad (1)$$

Where δ_i is a specific region effect (fixed effect), SI_{it} is a specialization index as specified by Alvarez (2007) that accounts for the different economic structure of the regions with respect to the whole country.

hc_{it} is an indicator of the healthcare system in region i. Cole and Neumayer (2006) found a negative impact of poor health on TFP. A good healthcare system is related to healthy people, i.e. more productive workers. In particular, we consider the number of beds in hospitals per efficient

worker, $Beds_{it}/N_{it}$.[11]

k_{it}^{pu} is a variable accounting for public infrastructure per efficient worker. Aschauer (1989) found a positive relationship between public capital stock and TFP for the United States. It is argued that poor infrastructure is one of the factors that may explain lowest per capita income and disparities in levels of productivity across the European regions. In this regard, the provision of infrastructure under the EU's regional policy has played a central role in reducing disparities in levels of productivity and per capita income in regions of the European Union.[12] Therefore, we consider "core infrastructure" per efficient worker in k_{it}^{pu}, which includes streets and highways, water systems, railways, airports, ports and other urban infrastructures provided by local governments.[13]

D_{it} is a vector of variables collecting the different combinations of parties ruling both levels of government and ε_{it} is an iid disturbance.

Let us define an explicit function form for (1) allowing B_{it} to evolve according to the following equation

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[11]Data on hospital beds in the regions are taken from the INE.

[12]Founded on the concepts of solidarity and economic cohesion, this policy will materialize through various financial measures, in particular those of the Structural Funds and the Cohesion Fund. In 1986, the Single European Act introduced the objective of economic and social cohesion. Finally, the Treaty of Maastricht (1992) incorporated this policy into the EC Treaty (Articles 158 to 162). For the 2007-2013 period, regional policy is the second largest budget item of the European Union, with a strength of 348 billion euros.

[13]These correspond to the classification by asset 2.1, 2.2, 2.3, 2.4, 2.5 and 2.6 according to the new methodology of the BBVA-IVIE Foundation.

$$B_{it} = B_{it-1} \left(\frac{SI_{it}}{SI_{it-1}} \right)^{\theta_1} \left(\frac{beds_{it}/N_{it}}{beds_{it-1}/N_{it-1}} \right)^{\theta_2} \left(\frac{k_{it}^{pu}}{k_{it-1}^{pu}} \right)^{\theta_3} e^{\left(\delta_i + D'_{it}\beta + \varepsilon_{it} \right)} \quad (2)$$

In our environment, right and left parties can hold office in both central and regional governments. However, regional parties can only be in charge of regional governments. Let us define the People's Party (PP) as a right party, and the Spanish Socialist Workers' Party (PSOE) as a left party.[14] Let R (L) be a dummy variable that takes the value of one when the right (left) party is in the central government, and zero otherwise. And let r, l, n be dummy variables that take the value of one when the right, left and regional parties respectively govern the i autonomous community, and zero otherwise. By constructing the interaction of dummies, we can specify the vector that collects the combinations of parties

$$D_{it} = (Rr_{it}, Ll_{it}, Rl_{it}, Lr_{it}, Rn_{it}, Rl_{it}, MR_t, ML_t)'$$

Where Rr_{it} (Ll_{it}) is a dummy variable that takes the value of one when the right (left) party simultaneously holds office at both levels of government, and zero otherwise; Rl_{it} (Lr_{it}) is a dummy variable that takes the value of one when the right (left) party is in the central government and the left (right) party is in the regional government, and zero otherwise; and Rn_{it}

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[14] Although the two main parties in Spain lean towards the center, we can unambigously classify the People's Party as a right-wing party, and the Spanish Socialist Workers' Party as a left-wing party.

(Ln_{it}) is a dummy variable that takes the value of one when the right (left) party is in the central government and a regional party is in the regional government, and zero otherwise.[15] We also introduce the variables MR_t and ML_t which are dummy variables that take the value of one when the right and left party holds a majority in the central government, and zero otherwise. These dummy variables allow us to control for the possibility of negotiation between central and regional governments headed by different parties. In line with common political practice, when central governments lack a majority, they are willing to make concessions to regional governments in order to gain support to pass a law, the national budget, a foreign mission, etc. In fact, the Spanish experience shows that regional parties can play a key role in forming the central government when a majority is not reached. On the contrary, when the central government holds a majority, they do not need partners and have no reason to negotiate in order to bring forward a proposal.

Taking natural logarithm in (2), we obtain the equation to be estimated

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\begin{aligned}
\triangle Log\left(B_{it}\right) = & \ \delta_i + \beta_1 Rr_{it} + \beta_2 Ll_{it} + \beta_3 Rl_{it} + \beta_4 Lr_{it} + \beta_5 Rn_{it} + \beta_6 Ln_{it} \\
& + \beta_7 MR_t + \beta_8 ML_t + \theta_1 \triangle Log\left(SI_{it}\right) + \theta_2 \triangle Log\left(\frac{beds_{it}}{N_{it}}\right) \\
& + \theta_3 \triangle Log\left(k_{it}^{pu}\right) + \varepsilon_{it}
\end{aligned}
\tag{3}
$$

Although we will rely on panel data regression, we first present the results

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[15]Notice that the first year of governance does not cover the whole year. Therefore if in the first year of governance the party took office before June, this variable takes the value of one, and zero after June.

of a pooled regression in Table 2. The results of the estimation are obtained for both measures of TFP (A_t and B_t).[16] Similar results were found for both measures of TFP at a 5% significance level. The more specialized the region, the higher the growth of TFP. According to the general literature and to the literature specifically related to Spain, the estimation of the parameters that collect the effects of the healthcare system and public infrastructure is positive and statistically significant at the 5% level and is higher when TFP is adjusted for human capital. Using data from the autonomous communities of Spain, Alonso and Serén Freire (2002) showed positive and significant effects of both parameters on the increments of total factor productivity and argue that this may partly explain regional differences in Spain. Aviles *et al.* (2001) suggest that public capital accumulation can be considered a tool for improving the competitiveness of Spanish firms since it reduces production costs. Along the same lines, Mas *et al.* (1996), Salinas-Jimenez (2003) and Álvarez and Delgado (2004) confirm that there is a significant positive contribution of infrastructure on both private production and the efficiency of Spanish regions.

As regards our variables of interest, none of the coefficients are significant at the 5% level. This result could be explained intuitively in the following manner. If major structural economic reforms or changes in economic policy did not occur during the period in question, there is no reason to expect a

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[16] Regressions for A_{it} use L_{it} instead of N_{it}.

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significant effect of party combinations on TFP. In fact, the Spanish experience shows that major changes in economic policy took place in the early eighties to modernize the economy and fulfill the requirements for European Union adhesion.

Table 3 shows the estimation results of the panel regression using the least squares dummy variable approach (LSDV) to estimate the individual fixed effects which are not shown for reasons of space. The results remain practically the same with respect to the pooled regression. We report the F-test (F_1) of null hypothesis of joint significance of the individual fixed effects and are unable to reject it (p-values in parentheses). It is also striking that when TFP is adjusted for human capital, the model is able to explain about 53% of the variability of the TFP growth rate.

4.2 An Extended Model

In this subsection we hypothesize that public infrastructure could also be affected by the different combinations of parties in the two levels of government. Our intuition is that the growth of productive public capital could depend on political arrangements or disagreements between the different government levels. Core infrastructure might take years of discussion before being implemented because of the different interests and points of view of the involved governance levels. The central government could even favor regional governments led by the same party, punish regions governed by other parties,

or the two levels of government may simply agree or disagree about undertaking public infrastructure projects. In fact, Castells and Solé-Ollé (2005) estimated an equation of infrastructure investment allocation for Spain accounting for political factors. Their results suggest that political factors explain the regional allocation of infrastructure.

We propose a simpler specification for the evolution of the growth rate of public infrastructure per efficient worker as follows[17]

$$\frac{k_{it}^{pu}}{k_{it-1}^{pu}} = e^{\left(D'_{it}\beta^k + \varepsilon_{it}^k\right)} \left(\frac{\hat{k}_{it}^{pu}}{k_{it-1}^{pu}}\right)^{\gamma^k} \qquad 0 < \gamma^k < 1 \qquad (4)$$

where $\hat{k}_{it}^{pu}$ is the optimal level of public infrastructure per efficient worker, γ^k is the adjustment coefficient and ε_{it}^k is an *iid* random disturbance. Let us specify $\hat{k}_{it}^{pu}$ as a linear function of the output per efficient worker, $\mathbf{y}_{it}$, as

$$\hat{k}_{it}^{pu} = e^{\left(\phi_i^k + \varphi_1^k \triangle Log(SI_{it})\right)} \mathbf{y}_{it} \qquad (5)$$

where ϕ_i^k is a constant term. We also allow the economic structure of the region to play a role in public capital accumulation.

Notice that whenever $D'_{it}\beta^k = 0$, no effect of combination of parties on public infrastructure accumulation is implied. Therefore, in the extreme case of $\gamma^k = 1$, the public infrastructure of a regional economy can only deviate from its optimal level due to a random disturbance and we would have that the expected value of public infrastructure equals its optimal level, $E\left(k_{it}^{pu}\right) =$

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[17]Our specification is in line with that of Nerlove (1958).

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$\hat{k}_{it}^{pu}$. Analogously, if $\gamma^k = 0$, $E\left(k_{it}^{pu}\right) = k_{it-1}^{pu}$, we expect no growth in public infrastructure. On the contrary, if $D_{it}'\beta^k \neq 0$ and $\gamma^k = 1$, the economy can deviate from the optimal level of public infrastructure due to the random disturbance and a political factor and we would have that $E\left(k_{it}^{pu}\right) = e^{D_{it}'\beta^k}\hat{k}_{it}^{pu}$. If $\gamma^k = 0$, the expected public infrastructure level could grow or decrease due to the political factor, $E\left(k_{it}^{pu}\right) = e^{D_{it}'\beta^k}k_{it-1}^{pu}$.

Taking natural logarithm in (4) we obtain:

$$\triangle Log\left(k_{it}^{pu}\right) = D_{it}'\beta^k + \gamma^k\left(Log\left(\hat{k}_{it}^{pu}\right) - Log\left(k_{it-1}^{pu}\right)\right) + \varepsilon_{it}^k \qquad (6)$$

and substituting (5) in (6), we write

$$\triangle Log\left(k_{it}^{pu}\right) = \gamma^k\phi_i^k + \gamma^k\varphi_1^k \triangle Log\left(SI_{it}\right) + D_{it}'\beta^k + \gamma^k Log\left(\frac{\mathbf{y}_{it}}{k_{it-1}^{pu}}\right) + \varepsilon_{it}^k$$

We now propose a simultaneous two-equation model as follows[18]

$$
\begin{aligned}
\triangle Log\left(k_{it}^{pu}\right) =\ & \delta_i^k + \beta_1^k Rr_{it} + \beta_2^k Ll_{it} + \beta_3^k Rl_{it} + \beta_4^k Lr_{it} + \beta_5^k Rn_{it} + \beta_6^k Ln_{it} \\
& + \beta_7^k MR + \beta_8^k ML + \theta_1^k \triangle Log\left(SI_{it}\right) + \gamma^k Log\left(\frac{\mathbf{y}_{it}}{k_{it-1}^{pu}}\right) + \varepsilon_{it}^k \\
\triangle Log\left(B_{it}\right) =\ & \delta_i^B + \beta_1^B Rr_{it} + \beta_2^B Ll_{it} + \beta_3^B Rl_{it} + \beta_4^B Lr_{it} + \beta_5^B Rn_{it} + \beta_6^B Ln_{it} \\
& + \beta_7^B MR_t + \beta_8^B ML_t + \theta_1^B \triangle Log\left(SI_{it}\right) + \theta_2^B \triangle Log\left(\frac{beds_{it}}{N_{it}}\right) \\
& + \theta_3^B \triangle Log\left(k_{it}^{pu}\right) + \varepsilon_{it}^B \qquad (7)
\end{aligned}
$$

where $\delta_i^k = \gamma^k\phi_i^k$ is the individual fixed effect and $\theta_1^k = \gamma^k\varphi_1^k$.

---

[18]The system written in the structural form is provided in the Appendix.

Notice that the simultaneous two-equation model is a triangular system. Assuming that the disturbances of each equation are not correlated, i.e. a diagonal covariance matrix, we can estimate the model recursively through OLS. It is known that under such assumptions the OLS equation by equation produces consistent and asynthotically efficient estimators since it is identical to the full information maximum likelihood estimator.

Table 4 shows the LSDV estimation for the first equation of the system (7). We present results for public infrastructure per worker (K_{it}^{pu}/L_{it}) and public infrastructure per efficient worker (K_{it}^{pu}/N_{it}). Notice that for both measures we find significant effects of some combinations of parties. Therefore, unlike TFP, public infrastructure is sensitive to combinations of parties in the different levels of government. In fact, we have found that when the left party holds office simultaneously in both level of governments and does not have a majority in the central government, a positive effect arises on public infrastructure accumulation. This result is in line with the general literature on Partisan Theory and specifically with the more recent evidence of Midtbø (1999) and Pettersson-Lidbom (2008), who found that growth of GDP was reinforced under left-wing governments due to higher spending. Our regional analysis allows us to say something more since our finding suggests that the higher spending on public infrastructure associated with left-wing governments does not benefit the whole country, but seems to be aimed at favoring self-governed regions. Moreover, notice that a left-wing government majority

implies a negative effect on public infrastructure accumulation. We therefore test the hypothesis of significance of combinations of parties when the left party has a majority in the central government

$$H_1 \quad : \quad \beta_2^k + \beta_8^k = 0$$

$$H_2 \quad : \quad \beta_4^k + \beta_8^k = 0$$

$$H_3 \quad : \quad \beta_6^k + \beta_8^k = 0$$

As can be observed in the second panel of Table 4, we do not reject H_1 and H_2, but do reject H_3 at the 5% significance level (*p- values* in parentheses). Therefore, according to the value of the estimates, the Spanish experience shows that when a left-wing central government enjoys a majority, there is a negative effect on the provision of public infrastructure in regions governed by regional parties.

Since we have found that some combinations of parties affect $\triangle Log\left(k_{it}^{pu}\right)$ and this in turn affects $\triangle Log\left(B_{it}\right)$, we can say that there is an indirect effect of combinations of parties on TFP accruing through the provision of public infrastructure.

It is also noticeable in Table 4 that the estimate of coefficient γ^k is significant at the 5% level and positive and less than one, thus fitting the requirement of our model. Incidentally, due to its low value, we can say that Spanish regions are far from the optimal level of public infrastructure.

In the third panel of Table 4 we also show the *F-test* (F_1) of null hypoth-

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esis of joint significance of the individual fixed effects for both measures of public infrastructure growth rate. In this case we reject the null hypothesis of no fixed effect at the 5% level for both measures of k_{it}^{pu}. Therefore, individual fixed effects do account for the growth rate of public infrastructure. We also provide the *F-test* (F_2) of null hypothesis of homogeneous individual fixed effects and reject it at the same level of significance. Therefore, Spain exhibits a heterogeneous individual fixed effect in the growth rate of public capital across regions.

Not fulfilling the assumption of diagonal covariance matrix of disturbances would imply inconsistent OLS estimations. Therefore, we can alternatively relax the assumption of diagonal covariance matrix and use the GLS estimator which produces consistent and efficient estimators as shown by Lahiri and Schmidt (1978). They pointed out that a system like (7) can be estimated as a seemingly unrelated equation model.

Table 5 shows that these results are not very different from the above ones. We also report Wald tests of H_1, H_2 and H_3 and of the null hypotheses of joint significance and homogeneous individual fixed effects (W_1 and W_2). Similar results were obtained for both measures of the TFP growth rate and the public infrastructure growth rate. Therefore, our results are robust to different methods of estimation and different measures of TFP.

Our results can be summarized as follows. First, we have found no direct effect of combination of parties on either measure of TFP. Second, the

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growth rate of public infrastructure positively affects the growth rate of TFP.
Third, we have found that certain combinations of parties affect the growth
rate of public infrastructure. Therefore, we claim that the combinations
of parties have a significant indirect effect on TFP through the provision
of public infrastructure. Therefore, doubts arise about the consolidation of
political institutions in Spain.

5   Conclusions

In this article we test the effect of different combinations of parties ruling the
central and regional governments on the economic growth of Spanish regions.
We assume that this effect, if indeed it exists, should accrue through the to-
tal factor productivity (TFP). Therefore, we perform a growth accounting
exercise to obtain the TFP growth rate series for the Spanish regions. After
specifying a functional form for TFP, we estimate a panel data regression
model controlling for individual fixed effects, specialization of the regions,
healthcare system and public infrastructure. In an initial stage we found
that $i)$ combinations of parties have no direct effect on the growth rate of
TFP. However, in line with previous literature, we have found that $ii)$
the growth rate of public infrastructure positively affects the growth rate of
TFP. In a second stage we hypothesize that public infrastructure can also
be affected by combinations of parties in the different levels of government,
since allocation of public infrastructure could depend on commitments or

disagreements between these levels. Therefore, we estimate a simultaneous two-equation model using public infrastructure and TFP growth rates as endogenous variables, finding that *iii)* combinations of parties have an indirect effect on the growth rate of TFP accruing through the public infrastructure.

Moreover, our main finding is that under left-wing central governments without a majority, a positive effect arises on public infrastructure accumulation in regions governed by the left party, i.e. left-wing governments favor regions governed by their same party. Additionally, under left-wing central governments with a majority, a negative effect arises in regions governed by regional parties. Therefore, doubts arise about the consolidation of political institutions in Spain.

Finally, our results are robust to different methods of estimations and measures of TFP.

Appendix

The equation system in the structural form with two endogenous variables, $n + g$ exogenous variables, n individuals and T observations for each individual can be written as

$$\mathbf{Z\Gamma} = \mathbf{XB} + \mathbf{E}$$

Where

$$\mathbf{Z} = \begin{bmatrix} Z_1 \\ Z_2 \\ . \\ . \\ . \\ . \\ . \\ . \\ . \\ . \\ Z_n \end{bmatrix}_{(nT) \times 2} \qquad Z_i = \begin{bmatrix} z'_{i1} \\ z'_{i2} \\ . \\ . \\ . \\ . \\ . \\ . \\ . \\ . \\ z'_{iT} \end{bmatrix}_{T \times 2} \qquad \text{for } i = 1, 2..n.$$

$$z'_{it} = \begin{bmatrix} \triangle Log\left(k_{it}^{pu}\right) & \triangle Log\left(B_{it}\right) \end{bmatrix}, \qquad \mathbf{\Gamma} = \begin{bmatrix} 1 & 1 \\ 0 & -\theta_3^B \end{bmatrix}$$

$$\mathbf{B} = \begin{bmatrix} \delta_i^k & \delta_i^B \\ \beta_1^k & \beta_1^B \\ \beta_2^k & \beta_2^B \\ \beta_3^k & \beta_3^B \\ \beta_4^k & \beta_4^B \\ \beta_5^k & \beta_5^B \\ \beta_6^k & \beta_6^B \\ \beta_7^k & \beta_7^B \\ \beta_8^k & \beta_8^B \\ \theta_1^k & \theta_1^B \\ \theta_2^k & \theta_2^B \\ \gamma^k & \gamma^B \end{bmatrix}_{(n+g)\times 2} , \qquad \text{with } \begin{bmatrix} \delta_i^k & \delta_i^B \end{bmatrix} = \begin{bmatrix} \delta_1^k & \delta_1^B \\ \delta_2^k & \delta_2^B \\ . & . \\ . & . \\ . & . \\ . & . \\ \delta_n^k & \delta_n^B \end{bmatrix}_{nx2}$$

$$\mathbf{X} = \begin{bmatrix} \mathbf{1}_T & & & & & & X_1 \\ & \mathbf{1}_T & & & & & X_2 \\ & & \mathbf{1}_T & & & & . \\ & & & . & & & . \\ & & & & . & & . \\ & & & & & . & . \\ & & & & & \mathbf{1}_T & X_n \end{bmatrix}_{(nT)\times(n+g)} \qquad X_i = \begin{bmatrix} x_{i1}' \\ x_{i2}' \\ . \\ . \\ . \\ . \\ . \\ . \\ x_{iT}' \end{bmatrix}_{T\times g}$$

$$x_{it} = \begin{bmatrix} Rr_{it} \\ LL_{it} \\ Rl_{it} \\ Lr_{it} \\ Rn_{it} \\ Ln_{it} \\ MR_t \\ ML_t \\ \triangle Log\left(SI_{it}\right) \\ \triangle Log\left(\frac{beds_{it}}{N_{it}}\right) \\ Log\left(\frac{\mathbf{y}_{it}}{k_{it-1}^{pu}}\right) \end{bmatrix}_{g\times 1} \qquad \mathbf{E} = \begin{bmatrix} E_1 \\ E_2 \\ . \\ . \\ . \\ . \\ . \\ . \\ E_n \end{bmatrix}_{(nT)\times 2} \qquad E_i = \begin{bmatrix} e_{i1}' \\ e_{i2}' \\ . \\ . \\ . \\ . \\ . \\ . \\ e_{in}' \end{bmatrix}_{T\times 2}$$

$$e'_{it} = \begin{bmatrix} \varepsilon^k_{it} & \varepsilon^B_{it} \end{bmatrix}$$

From our specification in (7), *it* turns out that $\theta^k_2 = \gamma^B = 0$.

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Table 1: Spain's Growth Accounting

	Average Annual Changes (%)		
	1988-2004	1988-1996	1996-2004
g(y_{it})	0.79	1.52	0.07
due to g(k_{it})	0.71	1.08	0.28
due to g(h_{it})	1.45	1.62	1.33
due to g(B_{it})	-1.37	-1.19	-1.54

Source: Authors' calculations

Table 2: Pooled Regression for the growth rate of TFP

	$\triangle Log\left(A_{it}\right)$		$\triangle Log\left(B_{it}\right)$	
	Coefficient	Std Error	Coefficient	Std Error
$Constant$	-0.0005	0.0049	-0.0067	0.0054
Rr	0.0023	0.0051	0.0038	0.0056
Ll	0.0072	0.0050	0.0045	0.0055
Rl	0.0008	0.0059	0.0036	0.0065
Lr	0.0040	0.0054	0.0016	0.0060
Rn	-0.0007	0.0059	0.0033	0.0066
Ln	0.0047	0.0057	0.0028	0.0063
MR	0.0022	0.0031	0.0022	0.0034
ML	0.0014	0.0031	0.0020	0.0034
$\triangle Log\left(SI_{it}\right)$	0.0145 *	0.0046	0.0126 **	0.0051
$\triangle Log\left(\frac{beds_{it}}{N_{it}}\right)$	0.1449 *	0.0346	0.2327 *	0.0362
$\triangle Log\left(k_{it}^{pu}\right)$	0.0749 **	0.0322	0.1256 *	0.0349
DW	1.9513		1.9384	
R^2	0.2272		0.4944	

* (**) Significant at 1% (5%)

Table 3: Panel Data Regression with Individual Fixed Effect for the growth rate of TFP

	$\triangle Log\left(A_{it}\right)$		$\triangle Log\left(B_{it}\right)$	
	Coefficient	Std Error	Coefficient	Std Error
Rr	-0.0034	0.0066	-0.0010	0.0073
Ll	0.0021	0.0061	-0.0002	0.0068
Rl	-0.0064	0.0077	-0.0017	0.0085
Lr	-0.0020	0.0073	-0.0043	0.0080
Rn	-0.0035	0.0086	0.0068	0.0094
Ln	0.0002	0.0076	0.0035	0.0085
MR	0.0025	0.0031	0.0021	0.0035
ML	0.0011	0.0031	0.0018	0.0034
$\triangle Log\left(SI_{it}\right)$	0.0149 *	0.0047	0.0127 **	0.0053
$\triangle Log\left(\frac{beds_{it}}{N_{it}}\right)$	0.1452 *	0.0355	0.2338 *	0.0371
$\triangle Log\left(k_{it}^{pu}\right)$	0.0757 **	0.0335	0.1378 *	0.0361
DW	2.0668		2.0405	
R^2	0.2802		0.5278	
F_1	1.0574	(0.3970)	1.1036	(0.3505)

* (**) Significant at 1% (5%)

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Table 4: Panel Data Regression with Individual Fixed Effect for the growth rate of public infrastructure

	$\triangle Log\left(\frac{K_{it}^{pu}}{L_{it}}\right)$		$\triangle Log\left(\frac{K_{it}^{pu}}{N_{it}}\right)$	
	Coefficient	Std Error	Coefficient	Std Error
Rr	-0.0068	0.0131	-0.0021	0.0145
Ll	0.0253 **	0.0119	0.0268 **	0.0131
Rl	-0.0085	0.0153	-0.0004	0.0169
Lr	0.0170	0.0142	0.0196	0.0157
Rn	-0.0294	0.0169	-0.0157	0.0186
Ln	-0.0008	0.0150	0.0062	0.0166
MR	0.0035	0.0061	0.0042	0.0068
ML	-0.0331 *	0.0082	-0.0436 *	0.0088
$\triangle Log(SI_{it})$	0.0054	0.0093	0.0013	0.0103
$Log\left(\frac{y_{it}}{k_{it-1}^{pu}}\right)$	0.1993 *	0.0328	0.2507 *	0.0307
H_1	0.3086	(0.5790)	1.1774	(0.2790)
H_2	0.9773	(0.3238)	1.7624	(0.1856)
H_3	4.1407	(0.0429)	4.1089	(0.0437)
DW	1.8725		1.7973	
R^2	0.6059		0.4449	
F_1	5.0328	(0.0000)	5.0075	(0.0000)
F_2	4.8094	(0.0000)	5.2848	(0.0000)

* (**) Significant at 1% (5%)

Table 5: Simultaneous Equation Regression with Individual Fixed Effect for the growth rates Public Infrastructure and TFP

	Without Human capital				Adjusted for Human Capital			
	$\triangle Log\left(A_{it}\right)$		$\triangle Log\left(\frac{K_{it}^{pu}}{L_{it}}\right)$		$\triangle Log\left(B_{it}\right)$		$\triangle Log\left(\frac{K_{it}^{pu}}{N_{it}}\right)$	
	Coef.	St Error	Coef.	St Error	Coef.	St Error	Coef.	St Error
Rr	-0.0033	0.0062	-0.0068	0.0125	-0.0010	0.0069	-0.0021	0.0138
Ll	0.0020	0.0058	0.0253 **	0.0113	0.0001	0.0064	0.0268 **	0.0125
Rl	-0.0062	0.0073	-0.0085	0.0146	-0.0018	0.0080	-0.0004	0.0161
Lr	-0.0020	0.0069	0.0170	0.0135	-0.0043	0.0076	0.0196	0.0149
Rn	-0.0033	0.0081	-0.0294	0.0160	0.0068	0.0089	-0.0157	0.0176
Ln	0.0002	0.0072	-0.0008	0.0143	0.0035	0.0080	-0.0062	0.0158
MR	0.0024	0.0030	0.0035	0.0058	0.0021	0.0033	0.0042	0.0064
ML	0.0011	0.0029	-0.0331 *	0.0077	0.0018	0.0033	-0.0436 *	0.0084
$\triangle Log\left(SI_{it}\right)$	0.0148 *	0.0045	0.0054	0.0088	0.0127 **	0.0050	0.0013	0.0098
$\triangle Log\left(\frac{beds_{it}}{N_{it}}\right)$	0.1450 *	0.0336			0.2338 *	0.0351		
$\triangle Log\left(k_{it}^{pu}\right)$	0.0793 **	0.0318			0.1370 *	0.0342		
$Log\left(\frac{y_{it}}{k_{it-1}^{pu}}\right)$			0.1994 *	0.0273			0.2507 *	0.0291
H_1			0.3435	(0.5578)			1.3072	(0.2529)
H_2			1.0861	(0.2973)			1.9567	(0.1619)
H_3			4.5991	(0.0320)			4.5618	(0.0327)
DW	2.0653		1.8725		2.0410		1.7973	
R^2	0.2801		0.6059		0.5278		0.4449	
W_1	20.0539	(0.2715)	95.0156	(0.0000)	20.8813	(0.2316)	94.5097	(0.0000)
W_2	20.0371	(0.2186)	85.4608	(0.0000)	19.1961	(0.2586)	93.8763	(0.0000)

* (**) Significant at 1% (5%)