

Green Public Procurement in Spain

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1. Introduction

The public purchasing of goods and services from an external source represents a notable percentage of GDP – increasing slightly over the last decade across OECD states from 11.8% in 2008 to 12.6% in 2019 (Badell & Rosell, 2021); (OECD, 2021) – and, unsurprisingly, impacts both market and government outcomes. The primary objective of public procurement is to deliver goods and services necessary to accomplish government missions in a timely, economical and efficient manner. These activities of public procurement are not, however, immune to addressing societal and environmental challenges, as witnessed by the development of green public procurement (GPP) or, as it has been called “public procurement for a better environment” (European Commission, 2008).¹ In July 2021, the European Commission (2021) published a report summarising the concerns of EU member states related to public procurement and identifying the principal challenges faced in the implementation of GPP. These can be briefly stated as:

- the difficulty to foster GPP practices due to the lack of legal obligation for contracting authorities to use environmental criteria in tendering procedures;
- the lack of legal certainty on the correct interpretation of the requirement for ‘link to the subject matter of the contract’ and the general fear of litigation; and,
- the lack of data on the effectiveness and economic benefits of applying GPP criteria and the difficulty to monitor their application.

¹ Or the process whereby “public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured” (European Commission, 2008)

In seeking to shed more light on these concerns, scholars to date have tended to undertake studies of a qualitative nature (Cheng et al., 2018), while any quantitative analyses have tended to examine tender procedures on an individual basis, thus reducing the scope of the analyses to a geographical area or administrative level. More recent works have started to introduce word-searching methodologies to detect GPP (Yu et al., 2020; Grandia & Kruyen, 2020; Rosell, 2021).²What is required is a whole empirical analysis that can inform policymakers about the appropriate actions required for a better implementation in relation to the positive impact that GPP can have on addressing environmental challenges.

This paper seeks to construct a bridge between government needs in relation to state-of-the-art GPP and scholarly interest in conducting in-depth analyses of GPP adoption in a specific country. As such, its first contribution is to analyse the role of two specific factors on GPP adoption: the effect of the fiscal year end and public procurement legislation. Although anecdotal evidence points to the importance of legislation in this regard, its effects on uptake levels have yet to be empirically demonstrated, given the dearth of such studies seeking to address this causality. Its second contribution is to provide an exhaustive examination of GPP in Spain. And finally, the study's third contribution is to break down GPP adoption for this one country by administrative level. More specifically, the study targets different authorities within each tier – central, regional and local – of government, controlling for a range of different effects.

The rest of this article is organised as follows. The next section seeks to frame the contributions identified in the previous paragraph in the context of the extant literature. Section three describes the data and methodology used to detect GPP and outlines the model

² (Yu et al., 2020)(Yu et al., 2020)(Yu, Morotomi, and Yu 2020)(Yu et al. 2020)(Yu, Morotomi, and Yu 2020)⁶(Yu et al., 2020)⁶⁶(Yu et al.)Yu, Morotomi, and Yu.

and variables employed. Section four reports the general summary statistics, the regressions and robustness checks. Section five explores the implications of the previous findings for policymakers and researchers alike, while section six concludes.

2. GPP literature review

2.1. Legislation

In the European Union, the 2014 Directive on public procurement and utilities failed to make GPP mandatory for Member States. Indeed, the initial draft drawn up by the European Commission and the absence of any amendments during negotiations in the European Parliament and Council seem to confirm the lack of interest in making GPP mandatory (Badell and Rosell, 2021). In the subsequent transposition, each Member State was at liberty to implement a voluntary or compulsory approach to green procurement. This voluntary uptake hampers GPP adoption in different EU member states (Pouikli, 2020) Spain opted for a more pro-environmental approach. Indeed, Fuertes Giné et al. (2022) place Spanish legislation on a “higher step of environmental imperativeness” than that occupied by Swedish law. The latter opted to transpose the Directive in a more conservative fashion, making GPP voluntary in a country that has long been identified as a front-runner in sustainable procurement. In the Spanish case, the legislation is clear from the very first article:

Environmental criteria will be incorporated in a transversal and mandatory manner, provided that it is related to the object of the contract, in the conviction that their inclusion provides a better value for money in the contractual provision.³

Moreover, it should be stressed that the Spanish Procurement Law applies to all awarding entities at all levels of government and related entities.

However, more generally, all EU Member States incorporated the obligation to procure in line with the *most economically advantageous tender* (MEAT) criterion, which ensures contracting authorities control for quality in the procurement process and not solely price. Although using the MEAT criterion implies that the lowest offer need not necessarily be awarded the tender, the application of convex formulas to the price criterion can imply a reduction in the final price (Chapela, 2019). However, in what concerns us here, the adoption of GPP in conjunction with the MEAT criterion is a clear indication that a concern for quality forms part of the procurement process.

2.2. Fiscal year end

Many organizations operate budgets that expire at the end of the fiscal year, having some consequences. The first one is that many countries face year end spikes in public procurement (McCue et al., 2021). And the second is related to a lower quality of this spending. Liebman and Mahoney (2017) report a surge of spending at year end among federal agencies in the US and find this end-of-year spending to be typically of lower quality procurement. Indeed, the odds are 2.3 to 5.6 times higher that procurement will be of lower

³ Law 9/2017, of 8 November, on public sector contracts (“Law 9/2017”), which transposes European Directive 2014/23/UE and Directive 2014/24/UE.

quality. One mechanism that has been identified as being active here is that of *procrastination* – i.e. the least effective acquisition professionals get their contracts ‘out the door’ at the end of the year. Baumann (2019) finds that procrastination can be particularly evident in the UK at the expense of a more precautionary bureaucrat model. There is less evidence of bureaucrats setting aside funds for a *rainy day* to meet unexpected spending demands towards the end of the fiscal year. Likewise, Eichenauer (2020) does not find sufficient evidence to link these demand shocks and year-end spending spikes in a cross-country analysis. However, she does find higher administrative quality to be associated with lower year-end spending spikes. Liebman and Mahoney (2017), moreover, report a 7 per cent increase in contracts receiving just a single bid in these weeks. Thus, there appears to be a modest increase in “risky” non-competitive one-bid contracts at the end of the year, perhaps reflecting the time restrictions on putting a bid together. Another significant effect recognised by the authors is that there is an evident fall in the number of contracts that require the contracting officer to obtain extra levels of approval. They stress that this may be difficult to obtain given the typical end-of-year pressures. In short, the shift in contract type and the rise in competitively sourced contracts receiving only one bid are consistent with a mechanism in which contracting officers face substantial time pressure and choose to use less time-intensive contract vehicles when they have sufficient discretion.

Most public procurers apparently possess a *stewardship motivation* for societal objectives (Davis, Schoorman and Donaldson, 1997) that shapes their positive attitude to GPP. Yet, at the same time, they are often painfully aware of, and seek to forestall, any administrative risks and complications (Plaček et al., 2021). As such, this might constitute another mechanism by which year-end GPP is avoided: reducing uncertainty that the contract notice will be published before last year day. Another period of the year during which routines might be disrupted coincides with civil servants’ holidays. Procurement procedures can be more costly

when regular production process are altered, which means that, while alternatives exist, procurers tend to avoid certain weeks of the year. This being the case we can expect a spike in public procurement before civil servants' vacations, a period that again is likely to be linked to a lower quality procurement process. Thus, lower levels of GPP can be expected some weeks before civil servants go on holiday and again while they are away on holidays.

All in all, the evidence of a link between low quality spending and year-end spending is fairly persuasive. A quality deterioration in public procurement may be linked to a lower proportion of GPP. So, if year-end spiking is confirmed for Spain and is more intense than in other EU countries (McCue et al., 2021), GPP can diminish in Spain at year end.

2.3. Administrative levels and Spain

In the EU, the contribution of local stakeholders, especially that of local authorities, has been especially important in establishing and disseminating GPP (Ladi and Tsarouhas, 2017). Indeed, lower tiers of government seem more prone to implement GPP (Rosell, 2021). Other studies limited to more specific areas, report similar findings (Testa et al., 2012; 2016). In China, local procurement officials present a keen awareness of GPP implementation policies and undergo GPP training, which has a direct impact on municipal GPP performance (Liu et al., 2019). However, differences have been found to exist in GPP implementation between the regions of a single country – for example, Grandia and Kruyen (2020) report a comparison of three Belgian regions based on a text-mining of thousands of procurement processes. In US (Dimand, Ana Maria & Cheng, 2022) find that local governments with centralized procurement are less prone to implement GPP.

The first cross-country comparison was reported by Renda et al. (2012), which focused on European countries. In the case of Spain, the authors sent out questionnaires to forty

contracting authorities and analysed some hundred contracts. Spain was found to rank in the middle of twenty-one European countries in terms of GPP adoption. Almost a decade on, Rosell (2021) analysed more than a million procurement processes in the EU and other European countries and found Spain to be ranked among the top third of GPP adopters. Fuentes-Bargues et al. (2018) analysed the work contracts of Spanish universities and found GPP to stand at a level of 19.2%. They stress that this share is low in comparison with the rates reported in other studies of local, regional, and national administrations in Spain. At the regional level, Braulio-Gonzalo and Bovea (2020) analysed 43 tender processes for furniture, but failed to reach a clear conclusion as to which regional governments lead the way in GPP. In short, there is no clear picture of the level of GPP implementation in Spain today. The Spanish public procurement system is composed of one single legal framework and a wide diversity of contracting, management and oversight institutions, the result in the main of the country's decentralized political system (European Commission, 2014). Yet, to date, no attempt has been made to undertake a large-scale analysis of public procurement in Spain.

3. Empirical strategy

3.1. Data and Methodology

We draw on the Tenders Electronic Daily (TED) database, which contains all active calls for tenders published in the Supplement to the Official Journal (OJS) of the European Union. We select all active contract notices for Spain between 2012 and 2019, the last available year. The total value of these contract notices is 120.1 billion euros. Given that the OECD (2021) reports that 10% of government spending in Spain is dedicated to public procurement, our database therefore covers approximately 50% of the country's total procurement.

Our goal here is to establish an objective measure of GPP adoption across Spain’s contracting units. The general application of this methodology is outlined in Rosell (2021). However, briefly, we conduct a word search – in all of Spain’s official languages and in English – in all the awarding criteria contained in the contract notices looking for terms related to green award criteria. We focus specifically on the terms ‘environment’ and ‘sustainable’, but also include ‘carbon footprint’, ‘life cycle assessment’ (LCA) and ‘emission standards’, among others. In Table 1 we summarize the frequency of different words, being words related to environment the most frequent ones. The results in Galician and Basque languages are almost zero. Most of the results are in Spanish, followed by Catalan and, the third one is English. When a contract notice is classified as GPP, the frequency of finding only one words is 87.2% while two words is 11.8%. The remaining one per cent is between three and five green words in a contract notice. Words referring to Circular Procurement (e.g. circular) or Sustainable Procurement (e.g. social), beyond GPP, are excluded. We should stress here that, as such, we cannot capture all aspects of GPP, for example, terms appearing elsewhere in the contract notices, such as the technical conditions and contract performance clauses.

Table 1. Green words frequency

Word	Frequency (%)	Word	Frequency (%)
Environment	59.23	Emission	7.37
Sustainable	8.22	Energy and renewable	5.16
Ecological	7.03	Life Cycle Analysis	5.60
Environmental label	2.15	Electric	2.62

Greenhouse gases	2.10	Pollution	0.01
Carbon footprint	0.51		

In line with the methodology employed, we break down different levels of government and different types of organisation, the aim being to separate out as many institutions as we can without reducing the reliability of our GPP analysis. It is worth mentioning that all Spanish public organisations are under the same central government procurement law. Thus, at central, regional and local levels, we distinguish between the specific general government body, agencies, public law authorities and utilities. The general body in central government is a ministry while at regional level, the equivalent in executive power but at regional government level (regional ministry). Agencies are outside specific government bodies, having their own budget and certain independence. These characteristics are maintained in public law authorities, although they also have more flexibility (e.g. recruitment). Utilities are companies that operates public services such as water, electricity, gas... Some of these sectors are natural monopolies. These utilities are typically regulated by the national, state or local government. Universities are dealt with separately from regional governments; and, at the level of local government, we separate out city councils, supramunicipal institutions (*mancomunidades*, *consejos comarcales*, *agrupación de municipios*, among others) and provincial councils (*diputaciones*). For every contract notice, the authority's postal code is available, so they can all be classified at the NUTS-2 and NUTS-3 levels.

Since many contract notices include many different lots, here we opted to delete lots when they are above one. Therefore, we keep contract notices without lots, those with only one and, we only keep one lot if there is more than one, selecting the first of them. Thus, our database comprises 83,250 observations, of which 38,661 correspond to the most

economically advantageous tender criteria and the rest to the lowest price offer. After excluding the latter, the MEAT contract notices were found to be distributed as follows: central government (19.56 per cent), regional governments (46.91 per cent) and local governments (33.52 per cent). As mentioned above, the total value of these contract notices is 121 billion euros, of which 35.87 per cent corresponds to central government, 35.37 to regional governments and 28.43 per cent to local governments.

3.2. Empirical specification

We estimate the following equation in which each observation corresponds to one of the procurement processes described in the previous subsection:

$$\begin{aligned}
 GPP = & \beta_0 + \beta_1 \textit{Spanish_procurement_law} + \beta_2 \textit{Year_end} + \beta_3 \textit{Summer_holidays} \\
 & + \beta_4 \textit{Price} + \beta_5 \textit{Time_trend} + \beta_6 \textit{Authority} + \beta_7 \textit{Government_level} \quad (1) \\
 & + \beta_8 \textit{Number_lots} + \beta_9 \textit{Type_of_contracts} + \beta_{10} \textit{Sector} + \beta_{11} \textit{Area} \\
 & + \varepsilon
 \end{aligned}$$

Since our main objective is to analyse the effects of the *Spanish law*, *Year end* and *Summer holidays* variables on GPP, we would combine them including sector and regional (NUTS2) effects on different specifications. We estimate four empirical model specifications. Our final specification is the previous empirical specification (Table 4 on 4.2 Regressions subsection). Our first one does not include *Year_end*, *Summer_holidays*, *Type of contract*, *Sector* and *Area* variables. Second specification includes all variables except *Sector* and *Area* variables. Third specification includes all variables except *Area*.

3.3. Dependent and explanatory variables

Our dependent variable is a dummy that takes a value of one when the contract includes one or more of the green award criteria specified in Table 1, and zero otherwise. We estimate our empirical specification using a logistic regression.

Based on the literature review reported herein, and in line with their availability in the TED database and other databases, the following explanatory variables of GPP are employed in our analysis.

- *Spanish procurement law*: a dummy variable taking a value of one if the Public Procurement Law (9/2017) is in force, and zero otherwise. Since 9 March 2018, the procurement activities of all authorities in Spain are covered by this law that specifically promotes GPP.
- *Year end*: a dummy variable taking a value of one if the procurement announcement is made during the last three weeks of December, and zero otherwise (note, however, that as December 6 and 8 are national holidays in Spain, if the day immediately after 8 December is a Saturday, the variable takes a value of one starting the following Monday).
- *Summer holidays*: a dummy variable taking a value of one if the procurement announcement is made two weeks before the month of August (i.e. during July), and zero otherwise (again, note, these two weeks are defined according to the day on which 1 August falls).
- *Price*: contract value, in euros, without VAT, deflated to 2015 Spanish prices. The consumer price index is obtained from the IMF. To avoid cases in which the contracting authority may have confused the contract value with the unit price, values

below one thousand euros are omitted. This variable is in logarithms. A positive relation between price and GPP is expected in the model.

- *Time trend*: the year of publication of the contract notices is also included as a time trend. A positive value is expected as GPP has expanded over time.
- *Authority and level of government*: classified by level of government, i.e., central, regional and local. At each level, we distinguish between agencies, utilities, public law authorities and the general government body. At the local level, we distinguish between city councils, supramunicipal bodies and provincial councils. Universities are included as separate authorities at the regional level. Regional and local authorities, as obvious promoters of GPP, are expected to present a positive value.
- *Type of contract*: a categorical variable that classifies whether the contract is a supply, works or services contract. Supply contracts include more GPP award criteria, whereas service contracts include more performance clauses due to contract duration and fewer GPP award criteria.
- *Number of lots*: a continuous variable with the natural number of lots related to the contract notice. Contract notices with more than one lot only one observation is kept. It can be expected that contracting authorities that are able to publish contract notices with more lots, their personnel is better trained, so there is more probability to find GPP.
- *Sector*: a categorical variable specifying the contract sector – general public services, economic and financial affairs, housing and community amenities, health, education, urban public transportation, environment, social services, public order and safety, defence, ports, airports, railway services, electricity, gas and heat cycle, water and others. In the TED database, some observations correspond to more than one category and have been reclassified in the most suitable category. They represent less

than 0.3% of the total sample. Others include a large list of sectors that could not be readily classified as one category and have been omitted.

- *Area effects*: each contracting authority operates within its own specific area and can be subject to the influence of surrounding authorities or policies on GPP as a result of normative or mimetic pressures. Marked differences between areas are expected reflecting different levels of implementation.

4. Results

4.1. General description

In Table 2 we show some descriptive statistics. Around half of contract notices with GPP (48.9%) are published since the new Spanish procurement law was in force, while 32.4% of contract notices without GPP are published since this law was in force. There is evidence that both means are different from a t-test mean comparison. For contract notices with GPP, 3.8% of these contracts are published at the end of the year while, contract notices without GPP, 5% of these contract notices are published at the end of the year. A t-test reject the hypothesis that both values are the same, being evidence that there is less GPP at the end of the year. However, related to summer holidays, this difference is not that large; there is not evidence that a lower proportion of GPP contract notices are published on summer holidays. The mean value of a contract notice with GPP is 3.7 million euros while without GPP is 2.5 million euros. Although contracts with GPP are more expensive, there is not statistical evidence that this difference is significant. And related to the number of lots, contracts with and without GPP have approximately the same number of lots.

Table 2. Descriptive statistics on GPP and non GPP contracts

	GPP	Non GPP	

	Mean	Standard deviation	Mean	Standard deviation	T-test mean difference (p-value)
Spanish procurement law	0.489	0.5000	0.324	0.4679	0
Year end	0.038	0.1919	0.050	0.2188	0
Summer holidays	0.041	0.1989	0.045	0.2063	0.446
Price	$3.7 \cdot 10^6$	$2.4 \cdot 10^7$	$2.5 \cdot 10^6$	$3.7 \cdot 10^7$	0.110
Number of lots	1.531	3.0848	1.587	4.5490	0.568

In Table 3 we compare the proportion of type of contracts and level of government when they include GPP or not. Related to the type of contract, the most noticeable result is that works contracts represents a larger proportion (more than double) when there is GPP that when there is not. On the other side, service contracts represent a lower proportion when there is GPP in the award criteria. On the level of government, central government contract notices are less common when there is GPP while local government is more common when there are GPP practices.

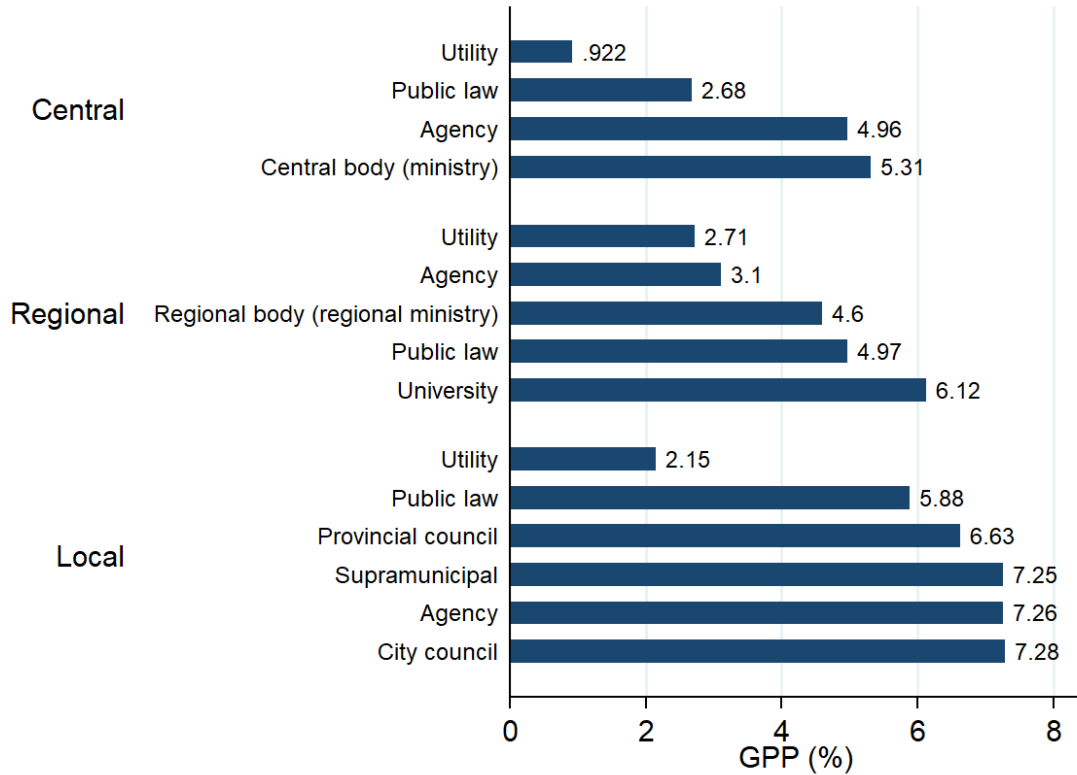
Table 3. Type of contracts and level of government proportion on GPP and non GPP contract notices

	GPP	Non GPP

	Mean	Standard error	Mean	Standard error
Goods	37.07	0.996	34.18	0.234
Works	6.89	0.522	2.79	0.081
Services	56.04	1.023	63.03	0.238
Central gov.	11.42	0.697	15.24	1.884
Regional gov.	44.65	0.109	50.93	2.620
Local gov.	43.93	0.109	33.83	2.479

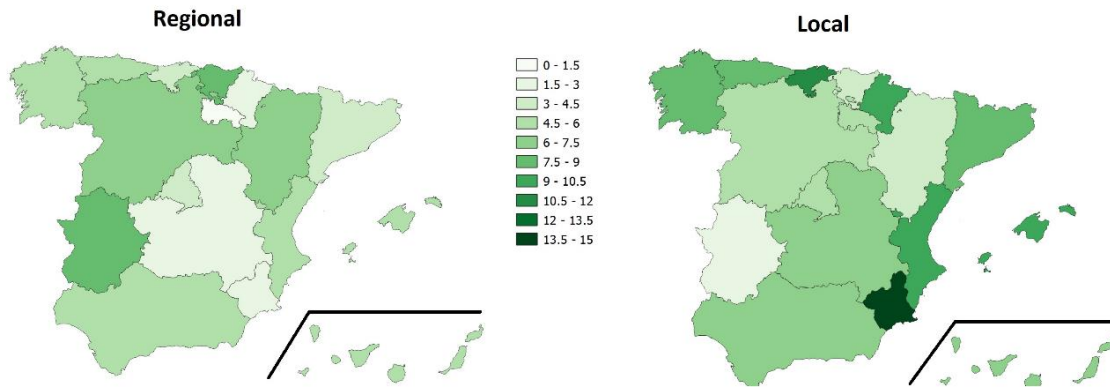
The GPP adoption rates for central, regional and local governments stand at 4.05, 4.78 and 6.92%, respectively. The results of a t-test reject the possibility that the GPP adoption rates of central and regional government are the same (95% confidence level) and that the rates of regional and local government are the same (99% confidence level). In Figure 1 we break these GPP rates down by authorities. It is evident that the local public sector is the front-runner in GPP adoption in Spain, with no differences in this regard between the activities of city councils and supramunicipal institutions. However, utilities are the *grey* authorities at all levels of government. The GPP adoption rate of the universities is comparable to that of the local authorities and they are the front-runners among the regional authorities. There is no statistical difference between the GPP adoption rates of regional and central bodies at the 95% significance level. Note that in the case of central government, central bodies (i.e., ministries) are the front-runners.

Figure 1. GPP adoption by authorities



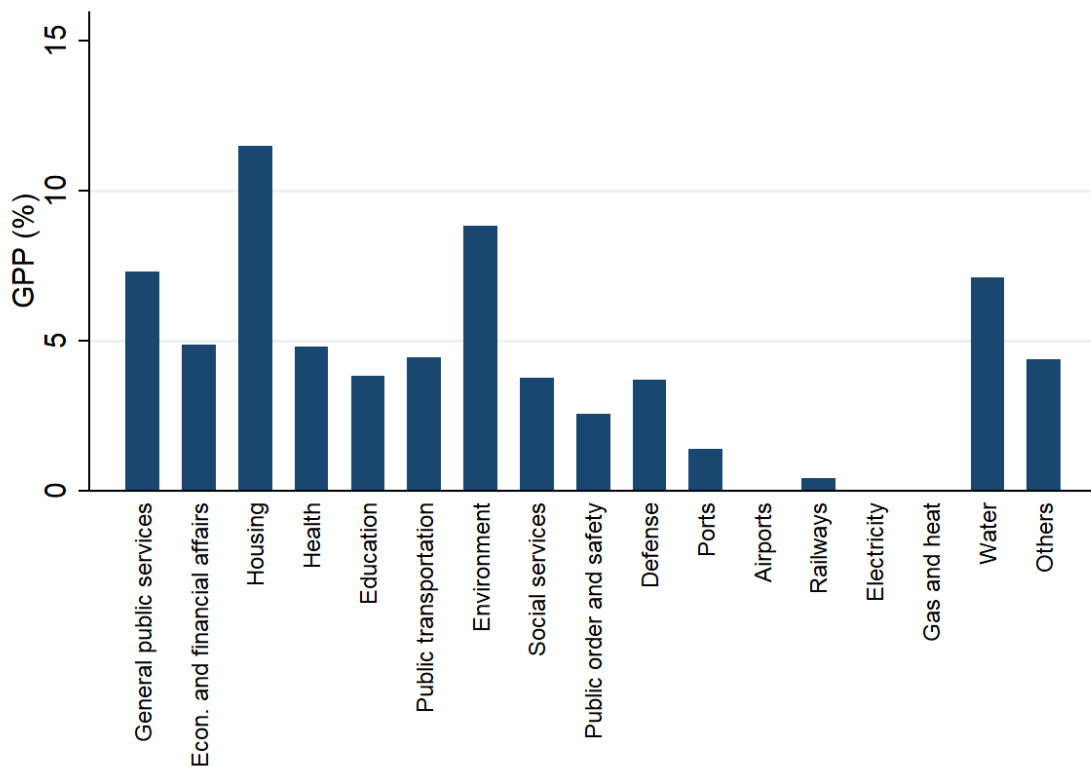
In Figure 2 we compare the level of GPP adoption by regional and local governments at the NUTS-2 level. We exclude central government because procurers take their decisions centrally and there is only a small number of observations for most of the regions. An initial inspection fails to identify any similarities between regional and local government at the NUTS-2 level. Indeed, a -0.44 pairwise correlation value (significant only at the 10% level) indicates an inverse relation between the two. At the regional level, Extremadura and the Basque Country are the front-runners, while La Rioja and Murcia are the laggards in terms of GPP adoption. However, at the local level, Murcia and Cantabria lead the way, while Extremadura and Aragon prop up the classification. Madrid performs below average at both the regional and local levels, while Catalonia presents an average GPP adoption rate at both levels.

Figure 2. GPP adoption rates of regional and local governments at the NUTS-2 level



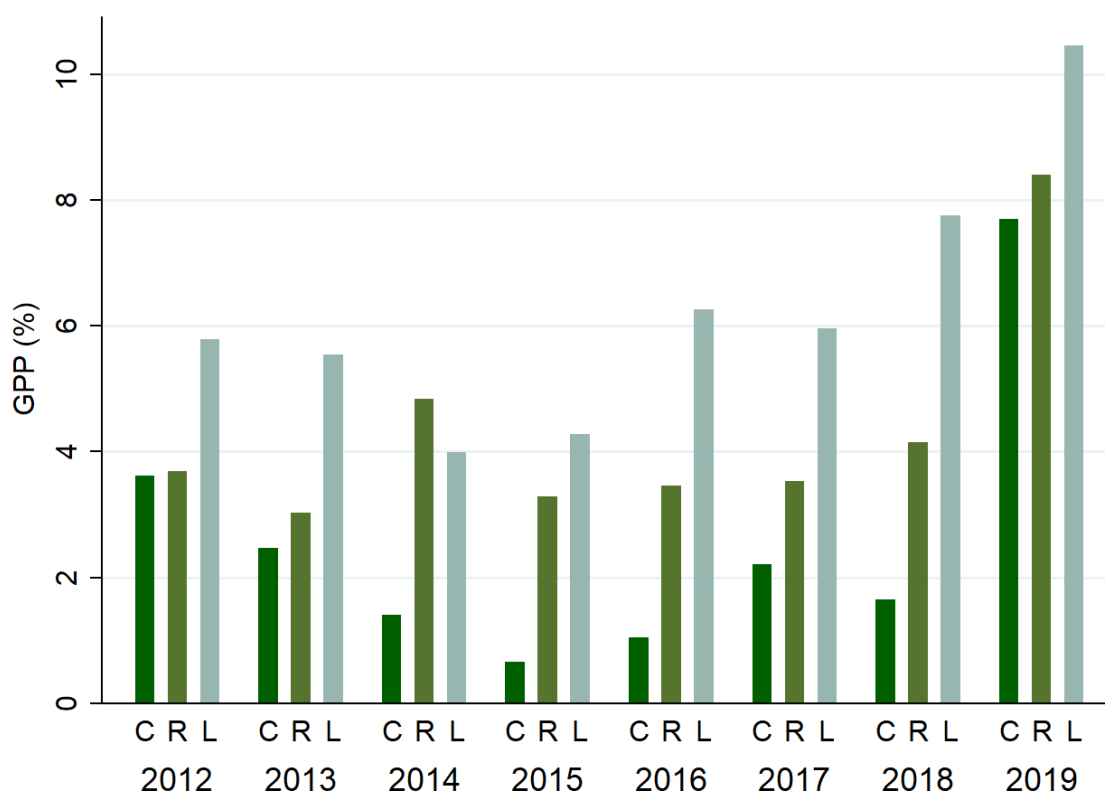
The housing sector is the front-runner in terms of GPP adoption, followed by the environment sector (Figure 3). On the other side, some sectors which can be consider pollutant intense, such as airports, electricity or gas and heat, have a low level of GPP adoption.

Figure 3. GPP adoption rates by sectors



Directive 2014/24/EU on public procurement was subsequently transposed by Spain, entering into force in March 2018. In Figure 4, we compare the GPP adoption rate on an annual basis by level of government. It is evident that local government has always led the way, while central government has struggled to keep pace with regional government. However, since the adoption of the new procurement law, the GPP adoption rate has increased at all levels of government. This effect is most evident at the central government level, although it is also non-negligible at the regional and local levels.

Figure 4. GPP adoption rate before and after new Directive

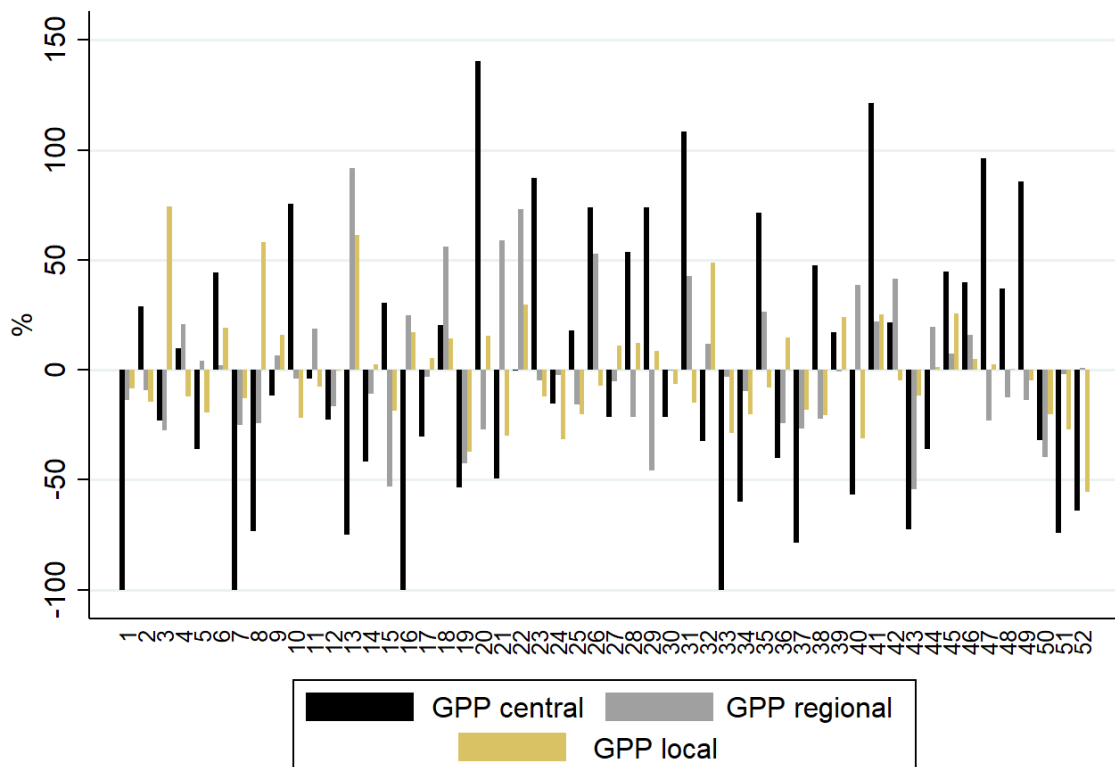


C: central; R: regional; L: local

Finally, our last descriptive statistics results refer to specific time effects on GPP. We generate a GPP mean for every week of the year for each of the three tiers of government (see Figure 4). A positive (negative) value is a week in which GPP is above (below) the yearly average. The fiscal year end in Spain, as in most European countries, falls on 31 December. The

longest period of time in which GPP for most levels of government falls below the average corresponds to the weeks leading up to the year end (Figure 5), particularly weeks fifty to fifty-two. Central and local governments present the most persistent negative values, while the effect on regional governments is more ambiguous. We also examined the period when Spanish civil servants are typically on holiday, that is, the month of August for the majority, when there is a tacit agreement that non-urgent administrative concerns operate minimum services only. This holiday period corresponds to weeks 32 and 35. Before these weeks (from mid to end of July) we do not appreciate any effect; however, in August there is a marked negative effect especially in the case of central government.

Figure 5. Weekly GPP minus yearly GPP by level of government



4.2. Regressions

Table 4 shows the logistic regression odds ratio and the significance level for the independent variables for the four different specifications. The models combine explanatory variables and

sector and/or spatial fixed effects. The total number of observations in our database is 38,661; however, depending on the information available for each explanatory variable, this number falls accordingly.

Our analysis of the logistic regression models from equation 1 shows a significance level of the likelihood-ratio chi-square test of 0.00 for all specifications. This is computed by comparing a model with no independent variables (i.e., the baseline model with the constant only) with a model fitted with these variables. Based on the results of these tests, the evidence goes against the intercept-only model and in favour of the model with explanatory variables. The best model is the one that presents the lowest Akaike information criterion (AIC), which in this instance is model four. This includes all the variables as well as sector and NUTS-2 fixed effects and, hence, it is our preferred model (Specification 4). The values of the multicollinearity test lie between one and three for all models, and below four for all variables. McFadden's pseudo- R^2 value lies between 0.019 and 0.049.

The transposition of the 2014 Directive has a positive effect on green public procurement adoption, it is between 67 and 74% more likely to observe GPP given that new law was in force compared finding GPP when was not in force. There is a 31-34% less probability of finding GPP during the year end compared finding GPP to non-year end period, an outcome that is robust for all specifications. Summer holidays do not affect the probability of the adoption of more or less GPP.

Price is only significant and positive for one model, as we incorporate more explanatory variables, this impact loses its significance. As such, time can be seen to have had a positive effect on GPP adoption. Each year, *ceteris paribus*, the probability of more GPP contracts being entered into increases. This trend might be related to increased regulation and clearer guidelines, enhanced levels of green awareness and the better capabilities of personnel employed by the contracting units.

We find that regional and local governments show a greater preference for GPP than is shown by central government. However, in our preferred model, when we include sector and spatial effects, these differences disappear. These results serve to reinforce our hypothesis that a simple mean is not enough to compare different levels of GPP adoption since each contracting authority procures in specific sectors, some of which are likely to be more prone to GPP.

GPP is more prevalent in works contracts than it is in purchase and services contracts. It seems that flexibility and longer contract duration (the case of services contracts) are associated with a less frequent use of GPP in the award criteria. This result is linked to the ease of measuring green criteria. And, finally, there is no evidence that more lots imply more probability to include GPP.

Table 4. Logistic regressions on GPP

Dependent variable: GPP	Specification 1		Specification 2		Specification 3		Specification 4	
	Odds ratio	St.Err.	Odds ratio	St.Err.	Odds ratio	St.Err.	Odds ratio	St.Err.
Procurement law	1.735***	0.134	1.674***	0.130	1.718***	0.136	1.724***	0.138
Year end			0.688***	0.083	0.673***	0.082	0.663***	0.081
Summer holidays			0.896	0.106	0.876	0.106	0.882	0.107
Price (log)	1.041***	0.014	1.010	0.013	1.017	0.014	1.020	0.014
Time trend	1.041**	0.017	1.048***	0.018	1.035**	0.018	1.038**	0.018
Gov. level (central)								

regional	1.3397***	0.110	1.382***	0.110	1.311***	0.117	1.018	0.102
local	1.964***	0.155	2.028***	0.161	1.342***	0.119	1.034	0.102
Contract (Goods)								
Works			2.297***	0.243	1.773***	0.203	1.770***	0.204
Services			0.732***	0.037	0.638***	0.034	0.636***	0.034
Number of lots	0.986*	0.008	0.984**	0.008	0.987	0.008	0.987	0.008
Constant	3.1·10 ^{-37**}	1.0·10 ⁻³⁵	3·10 ^{-43***}	1·10 ⁻⁴¹	7.7·10 ^{-32**}	2.7·10 ⁻³⁰	2.7·10 ^{-34**}	9.5·10 ⁻³³
Sector effects	No		No		Yes		Yes	
NUTS2 effects	No		No		No		Yes	
Observations	36,461		36,461		34,271		34,271	
McFadden's R ²	0.0195		0.0287		0.0412		0.0489	
Likelihood ratio chi-square test (p-value)	294.85 (0.0)		433.93 (0.0)		598.2 (0.0)		713.4 (0.0)	
AIC	14,812.8		14,681.8		13,985.9		13,908.8	
*** p<.01, ** p<.05, *p<.1								

To detect different effects on GPP adoption attributable to the level of government at which the procurer works, we conduct the same analysis for the three tiers of government (Table 5) choosing our preferred model from Table 4 and including spatial and sector effects. Our primary objective is to determine whether the previous results are maintained (Table 4) and

whether the specific effects for each level of government vary or not. We find, first of all, that McFadden's pseudo- R^2 value differs completely according to the dependent variable. Thus, it is between three and four times higher in the case of central government than in that of the regional and local authorities. One of the reasons for its low explanatory power is that when internal explanatory variables are included, the pseudo- R^2 value increases (Testa et al., 2012), but when these variables are not specified, the pseudo- R^2 value decreases, as Brammer and Walker (2011) and Testa et al. (2016) have reported. In the regional and local regressions, we have hundreds of different contracting authorities but, in the case of central government, although these contracting authorities are different (ministries, agencies, public firms), they depend on the same government and so many of the internal characteristics are likely to be the same.

The 2014 Directive variable is significant for all levels of government, but its impact differs from one tier to another. Thus, while for local governments its introduction has only increased the probability of GPP adoption by 38.1%, the new law has meant a 3.98-fold increase in the likelihood of GPP adoption by central government. We do not detect any impact of the proximity of summer holidays on GPP adoption. However, the year-end variable is significant for both the central and regional government specifications. At the year end, the probability of finding a GPP procedure falls by 72.4% in the case of central government and by 31% in that of the regional governments. Given the values of this variable in both specifications, it seems that the proximity of the fiscal year end in Spain means bureaucrats in central and regional governments tend to avoid GPP in their procurement processes. Thus, the effect does not appear to be related to the proximity of bureaucrats' holidays, given that proximity to the summer holidays has no effect on GPP rates, but, at the year end, when holidays and the fiscal year end coincide, it is apparently the latter that affects GPP adoption.

The impact of the price variable also differs from one level of government to another. In the case of central government, a higher price reduced the probability of GPP while, at the regional level, no effect is recorded and at the local level, there is a positive and significant effect of price on GPP adoption. The type of contract is not neutral to the specific level of government. In the case of central government, works and services contracts are less likely to include GPP, while in the case of regional governments, works contracts are four times more likely to include GPP than are goods purchase contracts. At the local government level, there are no differences between goods and works contracts, while there is a 31.4% less probability of finding GPP in services contracts.

Authority effects are heterogeneous depending on the level of government. In central government, general bodies (i.e. ministries) and agencies are the front-runners as far as GPP is concerned. This is also the case in local government, with general bodies – in this instance, city councils – and agencies being the front-runners. At the regional level, only public law authorities and universities surpass the regional general bodies. Utilities and public law authorities are low adopters at both the central and local levels of government.

Table 5. Logistic regressions on GPP and level of government

Dependent variable: GPP	Central		Regional		Local	
	Odds ratio	St.Err.	Odds ratio	St.Err.	Odds ratio	St.Err.
Procurement law	3.980***	1.239	1.815***	0.223	1.381***	0.163
Year-end	0.276***	0.131	0.690**	0.121	0.769	0.150
Summer holidays	1.503	0.506	0.770	0.144	0.947	0.182

Price (log)	0.915***	0.031	1.008	0.020	1.068***	0.024
Time trend	1.082	0.090	1.017	0.026	1.062**	0.028
Type of contract (Goods)						
Works	0.289**	0.150	4.017***	0.633	1.125	0.226
Services	0.231***	0.040	0.738***	0.059	0.686***	0.059
Number of lots	1.061*	0.036	0.988	0.009	0.992	0.020
Authority (general body)						
Public law	0.413***	0.118	1.253**	0.119	0.520***	0.108
Agency	1.114	0.486	0.702**	0.116	0.901	0.147
Utility	0.495	0.222	1.120	0.709	0.192***	0.073
University			1.663***	0.239		
Supramunicipal					0.660**	0.123
Provincial council					0.987	0.119
Constant	$2.3 \cdot 10^{-70}$	$3.8 \cdot 10^{-68}$	$5.2 \cdot 10^{-17}$	$2.7 \cdot 10^{-15}$	$1.9 \cdot 10^{-54}$	$9.9 \cdot 10^{-53}$
<hr/>						
Sector effects	Yes		Yes		Yes	
NUTS 2 effects	Yes		Yes		Yes	
<hr/>						
Observations	4,451		17,377		11,575	
McFadden's R ²	0.2171		0.0689		0.0431	

Likelihood ratio chi-square test (p-value)	372.7 (0.00)	474.2 (0.00)	24920 (0.00)
AIC	1413.8	6488.3	5622.1

*** p<.01, ** p<.05, * p<.1

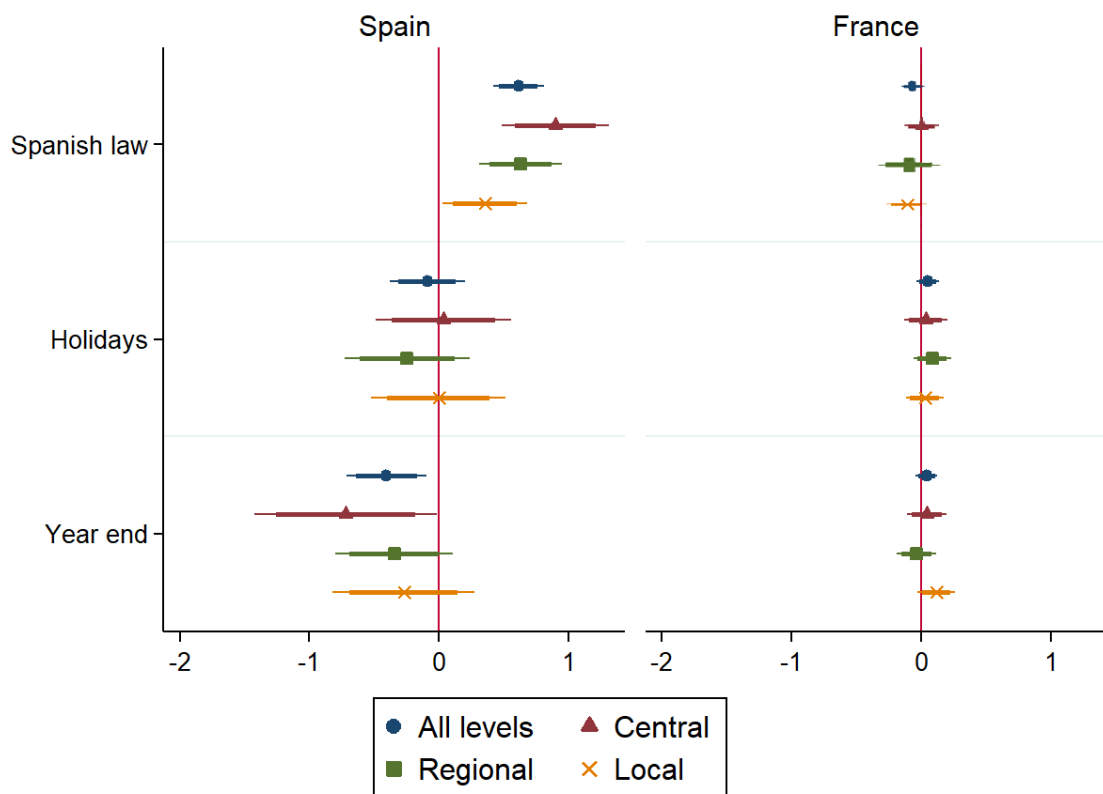
4.3. Robustness checks

Our primary purpose here is to demonstrate that these effects in Spain are not random and that there are no omitted variables that might bias our estimations. To do so, we include a second country, namely, France. We choose France, first and foremost, as it is the country with the largest number of contracts notices in the database. Second, the country also has three levels of government and its public procurement legal framework is centralised, as in Spain. And third, having transposed the Directive, new legislation came into force in France on 1 April 2016, approximately two years before the Spanish law was adopted. Our base model is the one with the lowest AIC value in Table 4. We select the same variables, substituting only the authority variable for a more restricted variable that only differentiates between central, regional and local government rather than between other types of authority (i.e. public law, agencies, utilities, etc.) due to difficulties in replicating the same categories in France.

We estimate our model for Spain and France, separately. For each country, we conduct estimates for all levels of government as well as for each level of government separately, as in Table 5. While for Spain we have 34,058 effective observations, for France we have 146,748. Figure 6 shows our parameter estimates for our target variables: Spanish public procurement law, summer holidays and year end with 95 and 99% confidence intervals. The

effects of the Spanish procurement law are significantly different from zero for all specifications at the 99% confidence interval level in Spain while in France we cannot reject that these effects are zero for all levels of government. It is worth pointing out here that although the confidence intervals are higher in Spain, the impact of the new legislation is high compared with that of other variables. For both countries, there is no evidence that the proximity of civil servants' holidays affects the probability of a reduction in the number of GPP actions.

Figure 6. Parameter estimates with 95 and 99% confidence intervals



In the case of the year-end effects, there are differences between the two countries. While in Spain there is a negative effect of GPP on central government estimations, there are no effects in France. A possible explanation for this is the 'medium-term dimension' of the French budget process. Legislation providing for the Programming of Public Finances have

greatly transformed the country's budget process in France by setting medium-term fiscal targets for each level of government (Moretti & Kraan, 2018).

A reviewer suggests we change GPP dependent variable definition as a robustness check. We have used a narrow definition, in which GPP only includes words related to environment, representing 59% of total GPP previously detected (Table 1). Compared with our most preferred specification in Table 4 (four), results are maintained.

Another robustness check involved a modification of our summer variable. We substituted the last couple of weeks of July with the month of August. However, this variable remains insignificant for all specifications and levels of government and no changes are detected either in the other explanatory variables.

5. Discussion

In 2019, the Independent Office for the Regulation and Supervision of Public Procurement in Spain stated that the strategic use of GPP remained deficient (OIRESCON, 2020). However, the coercive pressure brought to bear by governments can go some way to enforcing GPP (Raj et al., 2020). Indeed, developed economies are in a strong position to enact more stringent laws and impose higher coercive pressure to ensure adherence to environmental integrity (Adjei-Bamfo et al., 2019). The 2014 Directive provides an interesting opportunity to evaluate the role played by coercive pressure in 2018 and 2019. Here, before the law was implemented, it appears that local government opted to implement GPP in response, in the main, to mimetic and normative pressure, while the central government was exposed to less pressure of this kind. When the Procurement Law was enacted, the resulting normative pressure fostered greater adoption of GPP at the central government level, while the pressure brought to bear on local government in this respect was not as great. The legal framework operating before the transposition of the Directive

allowed GPP while the new framework actively promotes GPP and encourages its adoption. The clear implication here is that a law that specifically advocates GPP ensures that the more bureaucratic bodies will more readily adopt GPP.

Previous studies have found that local and regional governments are the front-runners in terms of GPP adoption (Renda et al., 2012). However, the importance here of controlling for sector has been stressed. For example, central government is typically responsible for military expenditure, a sector in which GPP is not as easily implemented as might be the case in other sectors. As such, the GPP adoption rate of central government is reduced in part by its competences as regards expenditure. In contrast, local governments are likely to be responsible for more pro-green competences and to face greater pressure from citizens to implement GPP, which ultimately favours GPP adoption. This means that before concluding that a particular tier of government implements higher or lower rates of GPP, we need to control for other variables. Recall that our first results on GPP adoption, as shown in Figure 1 and Figure 4, found local governments to be the front-runners, but that in the case of specification 4 (see Table 4) no differences were found between levels of government. Nissinen et al. (2009) recommended controlling for sector/product effects by means of econometric techniques, but it seems that literature has omitted to do so. Thus, a possible research line that could usefully be developed would be the comparison of rates of GPP adoption by level of government but controlling for their competences.

A key finding in the current study has been the identification of a year-end effect on GPP adoption. This reduction in central and regional governments is connected with the general idea that bureaucrats might tend to keep more funds for a *rainy day* and so end up spending it at the end of the year on lower quality procurements and, this behaviour is more common in larger governments than smaller ones (McCue et al., 2021). In autonomous regions in Spain (regional governments) a soft budget constraint has not implied imprudent behaviours

deviating from deficit rules (Calvo & Cadaval, 2022). Autonomous Communities have managed to stabilize their debt levels since 2016, and the public deficits have remained relatively low in contrast to the balance of central government accounts. This explanation and government size can explain why year end effects are more pronounced in central than in regional governments.

6. Conclusion and recommendations

Public administrations can use public procurement as a strategic tool for achieving sustainable outcomes. In this paper, we have described the current level of GPP implementation in Spain and the actions that might increase its adoption. Drawing on data from the Tenders Electronic Daily database for the period 2012 to 2019, we provide the first country specific analysis of GPP implementation for all levels of government.

Our results suggest the existence of a positive impact of legislation that encourages contracting authorities to adopt GPP. Such effects are evident for the more bureaucratic bodies at all levels of government (central, regional and local); however, for more flexible bodies (e.g. public firms, utilities and agencies) the effects are not so clear. The implication seems to be that a law which encourages GPP has an immediate effect, especially in the case of more bureaucratic bodies that may have been more reluctant to make this switch until the process is clearly laid out in the procurement legislation.

We report here, for the first time, empirical evidence that the fiscal year end can negatively impact GPP adoption, whereas civil servants' holidays have no such effect. Our raw data indicate that local governments are the front-runners, followed by regional and, finally, central governments. However, when we incorporate control variables (e.g. the main

procurement sector target), we find no differences between levels of government. This result points to the importance of controlling for these effects.

The study reported here has a number of limitations. First, the methodology we employ is only able to detect GPP uptake in part, due to the low resolution achieved by focusing solely on award criteria. This means we are unable to take advantage of further information that might be obtained from a tender's technical specifications and contract performance clauses. Second, and as discussed earlier, doubts have been raised about the reliability of certain observations in the TED database for some of the explanatory variables used here. A third limitation concerns the explanatory variables that we have opted to include as there are other factors describing the contracting unit that might also be relevant. And last but not least, endogeneity due to omitted variables, simultaneity and GPP measurement error can exist, might be implying biased estimators.

This paper has detected marked differences between the three levels of government in relation to certain variables. This analysis could usefully be replicated in other countries to determine why some variables affect one level of government and not another. Indeed, a cross-country analysis conducted for different levels of government would be an interesting outcome using spatial econometrics in order to detect, for example, spatial spillovers. This paper has, moreover, identified the possibility of linking the fiscal year end with GPP adoption. GPP has attracted considerable research interest in recent years (Cheng et al., 2018) and it is fair to say that the debate on the most cost-effective policy to curb year-end spending spikes has only just been initiated (Eichenauer, 2020). Here, the link between administrative quality, year-end and GPP opens up a clear opportunity for further research.

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