



Social and Political Factors Affect the Index of Public Management Efficiency: A Cross-Country Panel Data Study

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Abstract

The application of new technologies and the implementation of e-government have profoundly modified management systems in public administrations. In this article we create an index to measure efficiency in the management of public resources in the countries of the European Union for the period 2007–2012, both overall and in the management of resources in functions that generate most interest for citizens—education, health care, and social protection. In a second stage, we perform a cross-country panel data study to analyze how the implementation of e-government and other political and social variables influence the overall efficiency index and, by functions—human capita; state of development, democracy and corruption. Our results show that e-government, state of development, and human capital promote national expenditure efficiency. On the other hand, corruption promotes public inefficiency.

Keywords Public efficiency · Public management · Social factors

1 Introduction

The 1980s saw a profound change in the management systems of public administrations due to the implementation of the New Public Management (NPM). However, the economic crisis, citizens' demands for higher quality public services and the corruption problems that most of the developed countries have suffered have made it necessary to adopt measures to improve the systems of management and control in public administration. The measures taken include the introduction of new technologies such as the Internet which

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save costs and time, so favoring a more direct relationship between citizens and the administration and improving the quality in the provision of public services and transparency in public administration (Chadwick and May 2003; Borrás 2004; Chiang and Liao 2009; Verdegem and Verleye 2009). This system is known as “Network-Administration” (Welp et al. 2007) and has been applied by the United States Administration, and subsequently adapted by the majority of developed countries. With this system, we have intensified the internal control procedures and the adoption of measures to ensure transparency in the performance of public activities (Fountain 2005; Dreschler 2005; Olsen 2006). In addition, the latest measures taken seek greater participation of citizens in the management and control of public administrations—“Participatory Model” (Dunleavy and Margetts 2000; Fountain 2001; Chadwick and May 2003).

The application of all these measures and the adoption of these new systems of organization of public administrations are intended to improve the efficiency in the application of public resources by ensuring high quality public services, especially during times of economic crisis, characterized by the decrease of financial resources. However, one of the main problems of the public authorities is to be able to measure efficiency easily and realistically. Numerous studies have sought to facilitate its calculation through the application of different techniques and methodologies, with the most used being non-parametric analysis, DEA and FDH, which are better adapted to the peculiarities of the public administrations. Some authors, Afonso and St. Aubin (2005, 2006) and Moreno-Enguix and Lorente-Bayona (2017), have developed other methodologies, also non-parametric tests, which consist of the development of indices to determine efficiency in the management of public administrations.

Another important issue is to determine how certain variables affect efficiency in the management of public resources, and how the public authorities can improve the efficiency in the management of its resources through them. Analyzing what variables affect public efficiency can help governments to benchmark progress, identify gaps, and learn from best practices around the world, as well as determining which actions need to be focused on. Among the variables analyzed were those related to new technologies like e-government (La Porte et al. 2002; Demchak et al. 2000; Dunleavy et al. 2003; Chaddwick and May 2003; Thompson and Garbacz 2007; Sung 2007; Chiang and Liao 2009; Ala-Mutka et al. 2009; Huijboom et al. 2009) those relating to economic growth (Afonso and Alegre 2011; Balaguer-Coll and Prior 2009; Bose et al. 2007; Devarajan et al. 1996), corruption (Nguyen et al. 2017; Berg 2015; Kim and Kim 2014; Lewis 2018; Bosco 2016; Valle-Cruz and Sandoval-Almazán 2016) and gender-related variables and the operators of the public administrations (Hughes 2003; Pollitt and Bouckaert 2000; Mahoney et al. 2010). Among all these variables, we can highlight those relating to new technologies, since the reforms carried out by the different Governments in their management systems are linked to the application of new technologies and the creation of e-government. The economic crisis and corruption in recent years have accelerated the implementation and development of e-government. Governments seek with this system to improve efficiency, reduce corruption and improve relations with the citizens. However, the implementation of e-government requires sufficient training of its citizens and appropriate political structures that ensure security and transparency in the management of public services. It is necessary to analyse how these social and political variables affect the efficiency in public management.

Citizens and Governments are very interested in determining if the reforms carried out in recent years in their management systems improve the efficiency in the management of public resources. Due to the shortage of works that have examined this question in the countries of the European Union during the years of the financial and economic crisis

which affected these countries so deeply, our study aims to determine how e-government influences the efficient management of public resources in these countries over the period 2007–2012. Also, we will analyze the impact of the e-government on the efficient management of public resources by functions that were of more interest in citizens, such as health, education and social protection. For the study, we developed an index of efficiency measurement (Moreno-Enguix and Lorente-Bayona 2017), and made a disaggregated analysis of the efficiency by functions: education; health care and social protection. Furthermore, we analyse the relation between efficiency management of public expenditure and certain social and political variables like human capital, state of development, democracy and corruption, which are essential to organise and develop the management of public administration and to be efficient in managing public resources.

This paper is structured as follows. Section 2 briefly reviews the relevant literature. The data are then described in Sect. 3, followed by the presentation of the econometric specification in Sect. 4. The empirical results are discussed in Sect. 5, before concluding in Sect. 6.

2 Literature Review

Over the longer term, studies that measure *public efficiency* will contribute to highlighting best practices, learning about causes of performance differences among governments, and the impact of public sector reforms (Lonti and Woods 2008), as well as determining the actions that need to be focused on.

The studies on efficiency in the management of public resources have analyzed principally at the level of Local Entities, both at the global level, such as studying the efficiency in the provision of a particular service (Prior et al. 2002; Ortiz 2003; Balaguer 2004; Giménez and Prior 2007). State-level studies are not as numerous, and most of them are focused on specific functions, such as education and health care (Afonso et al. 2003, 2006; Afonso and St. Aubyn 2005, 2006; Eugène 2007; Herrera and Pang 2005; St. Aubyn 2003; Afonso et al. 2010; Samut and Cafri 2016).

However, the determination of the efficiency in the management of public resources is no longer sufficient. It is necessary to determine which variables influence efficiency and the effect produced on the same. Among the variables analyzed are the economic and social, including economic growth, the cultural level of the population, the level of economic activity or the level of income per capita (Taeyoung and Hongkyun 2017; Afonso and Alegre 2011; Sole and Shiuma 2010; Balaguer-Coll and Prior 2009; Lonti and Woods 2008; Bose et al. 2007; Giménez and Prior 2007; Afonso et al. 2006; Devarajan et al. 1996). In recent years, the economic crisis and the reform of public administration have contributed to the analysis of variables related to new technologies, corruption and type of government—democratic or non-democratic—of the different countries. The new technologies, and especially e-government, make it easier for citizens to conduct their affairs with government and to simply retrieve important information they need. E-government can increase efficiency of Kasemsap (2017), Azab et al. (2009), Von Walderberg (2004), Kearns (2004) and Yu (2008) and the relevance of the government in aspects relating to citizens and businesses. The significant advantages of e-government for businesses and governments include the reduced cost of doing business, increased access to information, and the growth in public esteem for governments. E-government changes the way that governments deliver online services and has become an integral part of governmental

strategies (Zhang et al. 2014). E-governments have become an increasingly integral part of the virtual economic landscape (Azab et al. 2009; Lim et al. 2012). Brewer et al. (2006) the application of e-government is a political decision of the Government and has a significant involvement in its activities and in its democracy. Although the link between IT/e-government and efficiency/service quality has been examined in the literature (Pang et al. 2014; Tan et al. 2013), it is not focused on national expenditure efficiency, at either the general level or by functions. Analyzing human capital or population's cultural level effects can give us more insights and lessons. Authors like Kasemsap (2017) and Azab et al. (2009) determine the relation between the increase of efficiency in provision of public services and the application of new technologies and the increase of level of training of its citizens to use these technologies. Chiang and Liao (2009) analyze the effect the application of new technologies on the activities of civil servants and on the efficiency in the management of public services. These authors determine that the standardization of the activities of civil servants through the application of new technologies such as Internet reduces costs, increases productivity of civil servants and therefore increases the efficiency in the management of public services. In addition, this new system increases the satisfaction of the citizens because it decreases the time to carry out administrative procedures

Saxena (2017), Taeyoung and Hongkyun (2017), Hessami and Uebelmesser (2016) and Blühdorn (2007) have published studies of how corruption and good governance affect efficiency in the management of public services. Although in many contexts the ideals of democratic governance and efficient governance are mutually obstructive, strong democracies have lower levels of corruption, largely because citizens give the government the legitimacy to govern and, therefore, the citizens can hold the government to greater transparency in its operations; and if money and resources available to government are diverted by corrupt officials instead of being channeled for the benefit of citizens, the clock turns back on social and economic development (The Economist Intelligence Unit 2012; Transparency International Corruption Perceptions Index 2012; United States Institute of Peace 2010). The studies of Lewis (2018), Bosco (2016) and Valle-Cruz and Sandoval-Almazán (2016) determine that administrations with low level of corruption have higher quality of public services.

Others authors have analysed the effect of develop of e-government on the administration of certain countries on the corruption (Andersen 2009; Charoensukmongkol and Moqbel 2014; Srivastava et al. 2016). These systems of management based on new technologies use measures to promote transparency in public activities and they allow for effective participation of the citizens and reduce corruption. Furthermore, the application of new technologies requires citizens with high level of training and establishes control procedures to guarantee their correct functioning.

3 Data

The global financial crisis of 2008 brought with it financial collapse, increasing yet further the interest of citizens in the good management of their government to have an efficient administration that satisfies the actual needs of citizens at the lowest possible cost.

Following Srivastava et al. (2016) and Moreno-Enguix and Lorente-Bayona (2017), we used four major data sources: International Monetary Fund Data (IMF DATA 2014) on Government Finance Statistics for the Expenditure by Functions of Government (COFOG);

United Nations E-Government Survey; Transparency International Corruption Perceptions Index (2012); and World Economic Forum (WEF) Global Competitiveness Reports.

Empirical analysis was applied for 6 years from 2007 through 2012, to study the effect before and after financial collapse. In order to facilitate its annual application to study the trend of future research, the data are annual values, instead of averages over a period of several years, which may eliminate the effects of random factors, such as certain errors in measurement.

Good quality data are needed because the techniques available to measure efficiency are sensitive to outliers and may be influenced by exogenous factors.

Data are collected on a regular basis through independent sources, so minimizing the burden on future researchers on the same topics and make the evolution map of the different variables.

To have a consistent panel data analysis, we needed data on similar constructs across all of the years, and this was the key factor that determined the time period we examined. Further, as the variables used in this study were taken from all four sources, it was essential to consider only those countries for which data were available in all the reports. Consequently, we were left with data from 25 European countries. Unfortunately, data availability outside of Europe is limited with regard to Expenditure by Functions of Government according COFOG classification.¹

Of the 25 European countries analysed some are European Union Member States -Austria, Belgium, Bulgaria, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, The Netherlands, Poland; Romania, Slovak Republic; Slovenia, and Spain—2 are EU candidate countries (Albania and Turkey) and other European countries are Azerbaijan, Georgia, Russia and Ukraine.

Efficiency cannot be directly measured. Composite indicators are very often by-products of efficiency measurements since they are constructed to serve as an input or output indicator.

The input–output ratio is the most basic measure of efficiency. However, compared to productivity measurement, the efficiency concept incorporates the idea of the production possibility frontier, which indicates feasible output levels given the scale of operations. The greater the output for a given input or the lower the input for a given output, the more efficient the activity is. Productivity, by comparison, is simply the ratio of outputs produced to input used (Mandl et al. 2008).

The analysis of efficiency is about the relationships between inputs, outputs and outcomes. The relative efficiency of spending (PEEI) is assessed using the model proposed by Moreno-Enguix and Lorente-Bayona (2017), by comparing expenditure levels and associated outputs.

Mathematically, *Public Expenditure Efficiency Index* is a weighted average of six (normalized) scores on the public efficiency by functions in line with the COFOG classification, namely: general public service, order and safety (GPSOS), economic affairs (EA), environmental protection, housing and community amenities (EP), health (HEALTH), education (EDUC), and social protection (SOC PROT).

PEEI is an output-input indicator to measure *public expenditure efficiency*, where output is a proxy of the public sector performance or an associated outcome by using more than 60 weighted socioeconomic indicators, which takes into account inter alia

¹ UN-Classification of the Functions of Government (COFOG): 01—General public services; 02—Defense; 03—Public order and safety; 04—Economic affairs; 05—Environmental protection; 06—Housing and community amenities; 07—Health; 08—Recreation, culture and religion; 09—Education; 10—Social protection.

Table 1 Descriptive statistics

Variables	Mean	Median	SD	Min.	Max.
PEEI	4.71	4.78	0.77	3.18	6.06
EGOVERM	0.64	0.65	0.11	0.42	0.91
HUMAN	0.72	0.89	0.29	0.27	0.99
GDPpc	23,315.83	16,103.99	16,705.98	2658.02	61,809.61
CORRUP	5.37	5.00	1.95	1.90	9.20
DEMOC	7.17	7.36	1.48	3.15	9.53

PEEI public expenditure efficiency, *EGOVERM* e-government, *HUMAN* human capital, *GDPpc* state of development, *CORRUP* corruption, *DEMOC* democracy

quality of public civil services. Input is the government expenditure as a percentage of GDP (see for more detail Moreno-Enguix and Lorente-Bayona 2017).

PEEI resulting score is a scalar measure ranging from zero (the lowest efficiency score) to one (the best-practice public sector).

E-Government (EGOVERM) is an assessment of the website development patterns in a country. We used the E-Government Development Index (United Nations E-Government Survey), which presents the state of E-Government Development of the United Nations Member States.

The E-Government Development index incorporates the access characteristics, such as infrastructure and educational levels, to reflect how a country is using information technologies to promote access and inclusion of its people. It is a composite measure of three important dimensions of e-government, namely: provision of online services, telecommunication connectivity and human capital.

Human capital (HUMAN) is the measure for a population's level of education, taken from the UN e-government survey. Human capital index is a weighted average composite of two indicators: adult literacy rate and the combined primary, secondary, and tertiary gross enrolment ratio, with two-thirds weighting assigned to adult literacy rate and one-third to the gross enrolment ratio.

According to Transparency International, *corruption* (CORRUP) is the abuse of entrusted power for private gain. It can be classified as grand, petty and political, depending on the amounts of money lost and the sector where it occurs. Corruption is assessed through the web measure Corruption Perceptions Index (Transparency International Corruption Perceptions Index 2012). Besides, in order to give robustness to the analysis, we have also repeated the statistical analysis with two other variables closely linked with corruption: *Public Trust in Politicians* and *Judicial Independence* (WEF).

Democracy (DEMOC) is assessed through the Democracy Index (The Economist Intelligence Unit 2012). Mathematically, it is an average of five (normalized) scores: *Electoral Process and Pluralism*, *Civil Liberties*, *Functioning of Government*, *Political Participation*, and *Political Culture*.

State of Development (GDPpc) was measured by Gross Domestic Product per capita in current U.S. dollars, taken from the WEF reports.

A Pearson correlation examined the strength and direction of the relationships between variables. The t tests associated can be interpreted as effect sizes, with values of .20, .50, and .80, reflecting a weak, moderate and strong correlation, respectively.

Table 2 Correlation matrix

	PEEI	EGOVERM	HUMAN	GDPpc	CORRUP	DEMOC
PEEI	1					
EGOVERM	0.566**	1				
HUMAN	-0.054	0.301	1			
GDPpc	0.509**	0.759**	0.134	1		
CORRUP	-0.618**	0.267*	0.021	0.333*	1	
DEMOC	0.665**	0.750**	0.105	0.837**	0.815**	1

**, *Significantly different from zero at the 0.01 and 0.05 levels, respectively

PEEI public expenditure efficiency, *EGOVERM* e-government, *HUMAN* human capital, *GDPpc* state of development, *CORRUP* corruption, *DEMOC* democracy

Main variable definition, descriptive statistics, and correlations matrix are presented in Tables 1 and 2, respectively.

Pearson correlations and statistical significances between variables show possible relationship between:

- *public expenditure efficiency* (PEEI) and *e-government* (EGOVERM); *state of development* (GDPpc); *corruption* (CORRUP) and *democracy* (DEMOC)
- *e-government* (EGOVERM) and *state of development* (GDPpc) and *democracy* (DEMOC)
- *state of development* (GDPpc) and *corruption* (CORRUP) and *democracy* (DEMOC)
- *corruption* (CORRUP) and *democracy* (DEMOC)

These results coincide with those obtained by the United States Institute of Peace (2010), according to which the right way to end corruption, improve people's standard of living and obtain more public efficiency is through a higher level of democracy. Multi-co-linearity does not represent a problem in our models, since, the indicator that is used to ensure that our results are not biased and the correlation between the explanatory variables (Marquardt 1970), the variance inflation factor (VIF), is in all cases within acceptable limits (Gujarati 2003).

4 Econometric Specification

Within the social sciences, panel data analysis has enabled researchers to undertake longitudinal analyses in a wide variety of fields.

Panel data have both, benefits and limitations. According to Pindado and Requejo (2015), the panel data methodology should be used if the unobservable heterogeneity problem arises. But panel data analysis has other benefits, such as more informative data, more variability, less co-linearity among the variables, more degrees of freedom and more efficiency. Panel data are better suited for studying the dynamics of adjustment, are better able to identify and measure effects that are simply not detectable in pure cross-sections or pure time-series data, allow us to construct and test more complicated behavioral models than purely cross-section or time-series data, and are usually gathered in micro units, like individuals, firms and households.

On the other hand, among the limitations we can highlight design and data collection problems, distortions of measurement errors, selectivity problems and short time-series dimension.

In our case, we have used static models, in both fixed and random effects, as this methodology allows the control of unobservable heterogeneity and avoid biased estimators. In this case it is important, as each country has its own culture and its own way of managing efficiency. The same methodology has been used by Horváthová et al. (2012), Eom and Rubenstein (2006), Samut and Cafri (2016) and Taeyoung and Hongkyun (2017).

The t tests associated with the regression coefficients can be interpreted as effect sizes, with values of .20, .50, and .80, reflecting a weak, moderate and strong change, respectively.

The main hypotheses and regression models and conceptual model are given below

Hypothesis 1 A higher level of Public Expenditure Efficiency, for general government, is associated with significantly a higher level of e-government, human capital, state of development, democracy, as well as with a lower level of corruption.

$$PEEI_{it} = \beta_0 + \beta_1 * EGOVERN_{it} + \beta_2 * HUMAN_{it} + \beta_3 * GDPpc_{it} + \beta_4 * CORRUP_{it} + \beta_5 * DEMOC_{it} + \varepsilon_{it}$$

In our first model, the dependent variable is the PEEI of each country (i) in each year (t), which is determined by the level of e-government (EGOVERN), in addition to a group of explanatory or control variables (HUMAN, GPDpc, CORRUP and DEMOC).

Hypothesis 2 A higher level of Public Expenditure Efficiency in education is associated with a significantly higher level of e-government, human capital, state of development, democracy, and with a lower level of corruption.

$$EDUC_{it} = \beta_0 + \beta_1 * EGOVERN_{it} + \beta_2 * HUMAN_{it} + \beta_3 * GDPpc_{it} + \beta_4 * CORRUP_{it} + \beta_5 * DEMOC_{it} + \varepsilon_{it}$$

In our second model, the dependent variable is the EDUC of each country (i) in each year (t), which is determined by the level of e-government (EGOVERN), in addition to a group of explanatory or control variables (HUMAN, GPDpc, CORRUP and DEMOC).

Hypothesis 3 A higher level of Public Expenditure Efficiency, on health care, is associated with a significantly higher level of e-government, human capital, state of development, democracy, and with a lower level of corruption.

$$HEALTH_{it} = \beta_0 + \beta_1 * EGOVERN_{it} + \beta_2 * HUMAN_{it} + \beta_3 * GDPpc_{it} + \beta_4 * CORRUP_{it} + \beta_5 * DEMOC_{it} + \varepsilon_{it}$$

In our third model the dependent variable is the HEALTH of each country (i) in each year (t), which is determined by the level of e-government (EGOVERN), in addition to a group of explanatory or control variables (HUMAN, GPDpc, CORRUP and DEMOC) (Fig. 1).

Hypothesis 4 A higher level of Public Expenditure Efficiency in social protection is associated with a significantly higher level of e-government, human capital, state of development, democracy, as well as with a lower level of corruption.

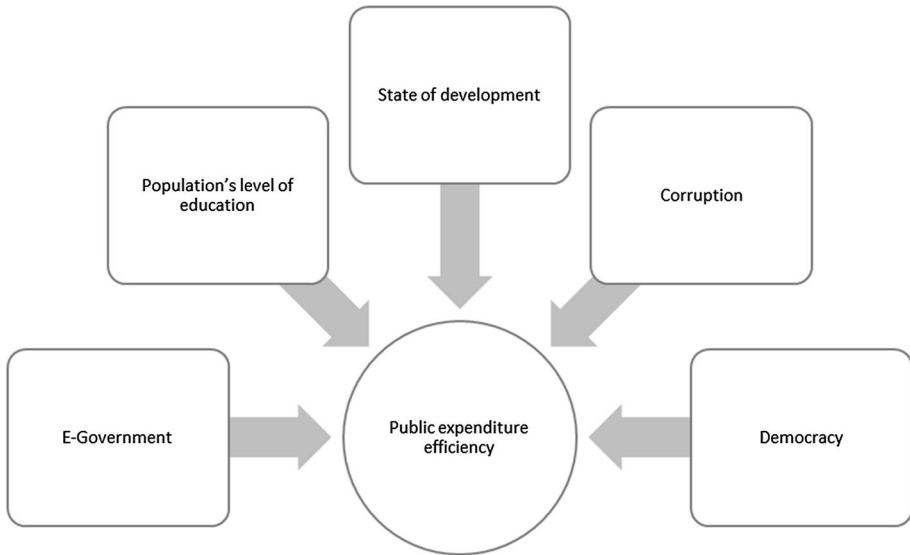


Fig. 1 Conceptual model

$$\text{SOC PROT}_{it} = \beta_0 + \beta_1 * \text{EGOVERN}_{it} + \beta_2 * \text{HUMAN}_{it} + \beta_3 * \text{GDPpc}_{it} + \beta_4 * \text{CORRUP}_{it} + \beta_5 * \text{DEMOC}_{it} + \varepsilon_{it}$$

In our fourth model the dependent variable is the SOC PROT of each country (i) in each year (t), which is determined by the level of e-government (EGOVERN), in addition to a group of explanatory or control variables (HUMAN, GPDpc, CORRUP and DEMOC)

5 Panel Regression Results

We analyze the empirical relation between expenditure efficiency and e-government by means of multivariate regression models. We estimate a cross-sectional OLS regression in our models. Model 1 analyzes the expenditure efficiency in general and in Models 2, 3 and 4 we study the efficiency by functions.

The results of Model 1 determine the positive and significant relation between expenditure efficiency and e-government. The use of e-government allows public authorities to improve and simplify the provision of public services and a better connection with the citizens. The results of our study show how *expenditure efficiency* (PEEI) is better when the authorities use *e-government* (EGOVERN) to provide public services. E-government decreases the administrative process and the number of civil servants to provide public services. This system produces a decrease in costs, and faster delivery of public services. Furthermore, these technologies make communication between the administration and citizens easier. Citizens can better control all administrative procedures, so maintaining a constant relationship with the administration. E-government favors transparency in management and operation of public administrations, so allowing the publication of economic and financial information. Our results coincide with those of Kasemsap (2017) and Azab et al.

(2009), according to which Electronic Government (e-Government) is regarded as a means for modernizing the public sector and increasing government productivity and efficiency. Von Walderberg (2004), Kearns (2004) and Yu (2008) determines that the use of e-government promotes efficiency. Karunasena et al. (2011), Alhsehri and Drew (2011), establishes the use of e-government and ITC increases efficiency in public services.

Therefore, our findings show that an organizational variable like *corruption* (CORRUP) influences the level of Efficiency negatively. Corruption decreases the quality of the provision public services (Nguyen et al. 2017). The principal reason for this is the decrease of financial resources and civil servant to provide public services. Furthermore, in public administrations, transparency and internal control system are enhanced. Our results show this situation, when corruption is lower, the expenditure efficiency is higher. The authorities need fewer financial resources and civil servants to provide quality public services and they have more resources to realize other activities. The economic and financial crisis has provoked an increase in measures to combat corruption in the provision of public services. We obtained this result in a previous work (Moreno-Enguix and Lorente-Bayona 2017), and it coincides with that of the World Economic Forum, according to which excessive bureaucracy and red tape, overregulation, corruption, dishonesty in public contracts, lack of transparency and the political dependence of the judicial system impose significant economic costs on businesses and slow down the process of economic development. This result is obtained by other authors, like Berg (2015), who affirms that when low efficiency is due to corruption rather than waste, there is a stronger consumption case for increasing public investment simply because extra waste is no longer a cost of scaling up. Nguyen et al. (2017) conclude that corruption significantly decreases the quality of public services. Other authors, like Kim and Kim (2014), Lewis (2018), Bosco (2016) and Valle-Cruz and Sandoval-Almazán (2016), have obtained the same results.

Our study finds a significant and positive relation between *expenditure efficiency* (PEEI) and *human capital* (HUMAN). When the level of education is higher citizens demands more quality public services and more efficiency in the financial management of public resources. The use of e-government and ICT to provide public services needs a level of education of citizens and civil servants.

Countries should make an effort to increase the level of education of their citizens, so it is easier to apply e-government in developed countries, as is analyzed in this work, than in others with a lower level of development and training of its citizens. In addition, the existence of important infrastructures and communication networks is also necessary, which happens in the countries of our study. These technologies increase the efficiency of public administration and the level of education of the population. Our results coincide with the studies of Kasemsap (2017) and Azab et al. (2009).

In relation to the others variables, we found no empirical evidence that *expenditure efficiency* (PEEI) is influenced by both a country's level of *democracy* (DEMOC) and its *state of development* (GDPpc).

Finally, Models 2, 3 and 4 shows the relationship between *expenditure efficiency* by functions and the variables of our study. There is no empirical evidence that the level of *efficiency in health* (VD=HEALTH) and *efficiency in education* (VD=EDUC) is influenced by *e-government* (EGOVERM); *human capital* ((HUMAN); *state of development* (GDPpc); *democracy* (DEMOC) or *corruption* (CORRUP). In health care it is necessary to study other key variables like the result of cultural or climatic factors. These public services have very special characteristics, and the application of e-government does not have as much influence as in other public services. These functions require a significant number of highly qualified professionals, whose procedures cannot be simplified by the application

Table 3 Multiple linear regression models

Models:

$$PEEI_{it} = \beta_0 + \beta_1 * EGOVERN_{it} + \beta_2 * HUMAN_{it} + \beta_3 * GDPpc_{it}$$

$$+ \beta_4 * CORRUP_{it} + \beta_5 * DEMOC_{it} + \varepsilon_{it}$$

$$VD_{it} = \beta_0 + \beta_1 * EGOVERN_{it} + \beta_2 * HUMAN_{it} + \beta_3 * GDPpc_{it} + \beta_4 * CORRUP_{it}$$

$$+ \beta_5 * DEMOC_{it} + \varepsilon_{it}$$

Model coefficients (Std. error)

Predictors	PEEI	VD=EDUC	VD=HEALTH	VD=SOC PROT
Intercept	3.718 (0.251)***	6.486*** (1.126)	6.977*** (1.204)	20.117*** (2.857)
EGOVERN	0.608 (0.256) **	-0.417 (1.146)	-0.086 (1.226)	10.172 (2.910)***
HUMAN	0.128 (0.040) ***	0.152 (0.182)	0.403 (0.194)	2.088*** (0.461)
GDPpc	2.700 (4.480)	-0.142 (0.637)	-0.425 (0.681)	2.406 (1.617)
DEMOC	0.115 (0.142)	8.640 (0.000)	0.000 (0.000)	0.470 (0.141)
CORRUP	6.003 (1.242) **	-10.748* (5.556)	-2.569 (5.943)	-0.001*** (0.000)
N	150	150	150	150
R ² (adjusted)	0.40	0.187	0.456	0.731
F	6.08***	2.08*	4.71***	24.48***

In the table are included panel data estimations in which the dependent variable is PEEI, EDUC, HEALTH and SOC PROT respectively

PEEI public expenditure efficiency, *EDUC* education efficiency, *HEALTH* health care efficiency, *SOC PROT* social protection efficiency, *EGOVERN* e-government, *HUMAN* human capacity, *GDPpc* state of development, *CORRUP* corruption, *DEMOC* democracy

*, **, ***Significantly different from zero at the 0.10, 0.05 and 0.01 levels, respectively, (two-tailed)

of e-government. They require the application of a significant amount of resources and they must reach all the population, even if that means in some cases a large increase in the costs of the service. In addition, the societies of the analysed countries require that these services reach all the population regardless of the cost involved. In relation to efficiency of education, some authors like Afonso et al. (2003) and Verhoeven et al. (2007) determine that other variables should be included in the model, like scale economies.

The regression results show that a higher level of *public expenditure efficiency*, especially in *social protection* (VD=SOC PROT), is associated with a significantly higher level of *e-government* (EGOVERN) and *human capital* ((HUMAN), as well as with a lower level of *corruption* (CORRUP). Some authors, like Porter (2005), Srivastava and Thompson (2007), determine that e-government enables social measures to be applied more easily, and the authorities can reach a greater number of citizens and provide more public services. Furthermore, the level of education of the population increases when the authorities promote more social public services (Table 3).

6 Conclusions

This paper analyzes the relation between public management efficiency and social and political factors. We use a sample of 25 European countries, most of them form the European Union, and from 2007 to 2012.

The results show that a higher level of *public expenditure efficiency* (PEEI), and in *public expenditure efficiency social protection* (VD=SOC PROT), is associated with a significantly higher level of *e-government* (EGOVERM) and *human capital* (HUMAN), as well as with a lower level of *corruption* (CORRUP). Therefore, the development of effective public services need e-government, which decreases corruption and increases transparency in administrative management and requires an appropriate level of training in the citizens to access new procedures of management. Our results agree with those obtained by others authors: Kasemsap (2017), Azab et al. (2009), Lewis (2018), Bosco (2016) and Valle-Cruz and Sandoval-Almazán (2016). However, we found no empirical evidence that the level of *expenditure efficiency in health* (VD=HEALTH) and the level of *public expenditure efficiency in education* (VD=EDUC) with the analyzed variables. These results show the special characteristics of these functions and the need to study other variables to increase their efficiency and quality (Afonso et al. 2003; Verhoeven et al. 2007).

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