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THE ROLE OF PUBLIC SPENDING AND THE QUALITY OF PUBLIC SERVICES IN E-GOVERNMENT DEVELOPMENT

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ABSTRACT. Numerous studies have concluded that trends in e-government development have spread throughout the world economy and that public sector performance is a significant determinant of this process. Moreover, an expansion in the available literature and data sources also present additional incentives to pursue new studies on changing patterns in e-government development. The current paper analyzes the association between e-government development (using the E-Government Development Index or EGDI as a proxy), government spending, and the quality of public services against the background of economic and population growth in 154 countries. The results met the assumption that economic growth (represented by GDP per capita), government effectiveness, and the Public Services Index would positively impact EGDI. However, government spending had a negative impact on EGDI index between 2008 and 2018, which potentially indicates inefficiencies in government expenditures on e-government development.

Keywords: *E-Government Development Index (EGDI), fixed effects, panel least squares, public services, random effects*

Introduction. Digital transformation will drive the majority of social and economic processes in the 21st century. Nowadays, there is ample evidence to show that e-government development increases quality of life and public service delivery. E-government development refers to a process in which public officials adopt information communication technologies (ICT) to increase the efficiency and effectiveness of government services to better satisfy stakeholders' needs [1].

E-government embodies a dynamic and interactive type of digital transformation facilitated by internet technologies [2]; innovative restructuring processes in contrast to traditional bureaucracy [3]; and an exchange system between public officials and public service customers [4]. Thus, e-government is an alternative mechanism for public service delivery [5]. In any given country, appropriate e-government development has a significant effect on overall economic growth, as mutual interactions between the state and citizens become more optimal and engaged. E-government reduces unwanted negative outcomes from old bureaucratic structures, such as high cost of services, corruption, and agency problems [6].

In addition, the concept of e-governance should be carefully differentiated from e-government. The latter refers to the delivery of daily or routine public services to increase the operability of the functions of society (for example, business activities), while e-governance aims to address more long-term and strategic aspects of the relationship between the government and citizens, such as policy demands and political representation [7]. Despite their differences, both e-government and e-governance development encompass social innovation activities, which have proven to be more efficient and noteworthy than other types of innovations, in order to overcome challenges that arise from old bureaucratic structures [8;9].

In other words, e-government is expected to fill gaps in public service delivery and to optimize the country's economic conditions, as it is a form of social innovation that aims to improve the macro quality and quantity of life [10]. However, a systematic and consistent investigation of the determinants of e-government development should not be ignored. The E-Government Development Index (EGDI) is a complex measure for analyzing e-government development patterns in various countries; however, few studies have used it to conduct quantitative empirical analysis.

Thus, this paper examines how economic growth, government spending, the quality and effectiveness of the public sector, and population growth impact e-government development. The research methodology consists of panel estimation techniques such as panel least squares, fixed effects, and random effects. The study used data from 154 countries.

Data and Methodology. Objective and consistent findings can be easily communicated via empirical studies [11]. Economics has evolved into an evidence-based science that provides the necessary theoretical and practical toolkits to understand social, political, economic, and institutional systems. The primary objective of this research was to examine the relationship between e-government development and the public sector; to this end, panel least squares, fixed effects, and random effects models were utilized. Table 1 reports the variables of interest collected from 154 countries from 2008 to 2018 (more precisely, 2008; 2010; 2012; 2014, and 2018).

Table 1. Variables of interest, their descriptions, and sources

Notation	Definition	Description	Source
<i>EGDI</i>	E-Government Development Index	E-Government Development Index provided by the United Nations to assess the website development and the education levels of the citizens to evaluate how the citizens are handling the digital transformation	United Nations reports
<i>GDP_PC</i>	GDP per capita growth rate	Current U.S. dollars	World Bank
<i>GOV_SP</i>	Government spending	As a % of GDP	
<i>GOV_EF</i>	Government effectiveness	Percentile rank	
<i>POP_GR</i>	Population growth	Annual %	
<i>PSI</i>	Public Services Index	Index value ranged between 0 (low) to 10 (high)	

The estimation model is given below:

$$EGDI_{it} = \beta_0 + \beta_1 GDP_PC_{it} + \beta_2 GOV_SP_{it} + \beta_3 GOV_EF_{it} + \beta_4 POP_GR_{it} + \beta_5 PSI_{it} + \varepsilon_{it} \quad (1)$$

In the model, i represents a country at time t for a given variable, and ε_{it} represents the error term. The signs for all coefficients are expected to be positive. Detailed information on the data is reported in Table 2. Gross domestic product (GDP) per capita and population growth are highly skewed, but other variables are fairly symmetric, according to skewness values. Due to the size of the data set, minimum, maximum, median, and mean values reflect the expectations.

Table 2. Descriptive statistics for the variables of interest

	EGDI	GDP per capita in current U.S. dollars	Government spending as a percentage of GDP	Government effectiveness as a percentile rank	Population growth as an annual percentage	Public Services Index on a scale from 0 (low) to 10 (high)
Min.	0.059	198.350	2.050	0.948	-2.097	0.000
Max.	0.946	118823.650	39.880	100.000	16.476	9.300
Median	0.504	5745.900	15.650	50.598	1.314	4.400
Mean	0.508	14843.045	15.939	50.742	1.465	4.568
St. dev.	0.208	20189.448	5.533	28.511	1.522	2.458
Skewness	0.058	2.075	0.625	0.026	2.411	0.100
Kurtosis	-0.924	4.624	1.132	-1.154	17.085	-1.111

The collected dataset was missing minor values, which are summarized in Table 3. All missing values were replaced by predicted values for each country based on the available period. The least squares method and Microsoft Excel's (version 15.26 for Mac OS X) TREND function was used to replace missing values.

Table 3. Classification of missing values according to country and year

Variable name	Country name and years
Government spending as a percentage of GDP	Ethiopia (2008, 2010); Haiti (2008); Iran (2018); Laos (2018); Malawi (2018); Panama (2018); Tajikistan (2018); Turkmenistan (2018); Bolivia (2016, 2018); Zambia (2016, 2018)
EGDI	Guinea (2010)
Public Services Index	Luxembourg (2018)

Results. Table 4 reports estimation results for the EGDI equation using panel least squares, fixed effects, and random effects for the period from 2008 to 2018. The majority of coefficients were statistically significant. While some coefficient signs aligned with expectations, others did not (e.g., government spending). In addition, R^2 and adjusted R^2 values were high for panel least squares and fixed effects, but random effects exhibited lower values. All F-statistic values were significant, which indicates the joint impact of explanatory variables on the EGDI. All three estimations showed cross-

section dependency. Furthermore, despite fixed effects indicating a normal distribution for the residuals, random effects were a more appropriate panel estimation for this dataset, according to the Hausman test.

Table 4. Estimation results on panel data set, 2008–2018.

	Panel least squares	Fixed effects	Random effects
Constant	0.222 (0.011)***	0.227 (0.032)***	0.203 (0.016)***
GDP_PC	0.001 (0.001)***	0.001 (0.001)**	0.001 (0.001)***
GOV_SP	-0.002 (0.001)***	0.001 (0.001)	-0.001 (0.001)**
GOV_EF	0.001 (0.001)***	0.001 (0.001)	0.001 (0.001)***
POP_GR	-0.02 (0.002)***	-0.010 (0.003)***	-0.012 (0.002)***
PSI	0.056 (0.003)***	0.049 (0.004)***	0.054 (0.003)***
R ²	0.850	0.943	0.625
Adj. R ²	0.849	0.931	0.623
F-statistic	1040.363	80.349	306.256
Prob. (F-statistic)	0.000	0.000	0.000
Cross-section dep.	20406.94***	21016.96***	20481.50***
JBN test	15.256***	4.149	11.067**
Hausman test (statistic)			14.061**

Note. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The numbers in parentheses represent corresponding standard errors. The cross-section dependency test reports the Breusch-Pagan LM statistic value. "JBN" refers to the Jarque-Bera normality test.

Conclusion. The coefficients for the constant, population growth rate, and PSI were relatively large and statistically significant, while other coefficients were small. The persistent negative sign for population growth might indicate that demographically large countries such as China, India, and Indonesia experience difficulties in improving e-government. Government spending also had a negative sign in the panel least squares and random effects models, which might be a sign of inefficient expenditures on e-government development. In other words, even if the country increases government expenditures, it may not favor e-government development while aiming to have more developed e-government or e-governance systems.

The positive sign for GDP per capita overlapped with the main theoretical expectation that economic growth fuels the EGDI and thus e-government development. The percentile ranks for government effectiveness indicated that a more efficient public sector was positively associated with better e-government development across all countries.

Overall, despite somewhat mixed results in the estimations, the findings generally established a solid connection between the EGDI and the quality and effectiveness of the public sector. Further research should reclassify the countries into developing, developed and outlier countries (i.e., excluding China) in order to achieve more accurate results. Although data from 154 countries can

yield valuable information about the global economy, countries highly differ in terms of available resources and capabilities for designing e-government development strategies and measures. Furthermore, a country's e-government development plans may not necessarily benefit from government spending or economic growth due to internal political, social, and bureaucratic issues, which usually point to institutional failures. Lastly, the aggregated and generalized nature of the study should be considered as the main limitation of the study.

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