European Economic Letters
ISSN 2323-5233
Vol 14, Issue 4 (2024)
http://eelet.org.uk

"Exploring the Impact of E-Government Evolution on Economic Growth across the Diverse Nations"

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Abstract*:*

This study examines the relationship between the evolution of e-government and economic growth in 11 randomly selected countries from 2003 to 2022. Using multiple linear regression and ARIMA modelling techniques, this study investigates the impact of e-government index on GDP per capita. The results show significant correlations between specific e-government indices and economic growth, highlighting the important role of digital infrastructure and open data initiatives in maximizing the benefits of e-government. The study concludes with recommendations for policy makers to improve online service delivery, mitigate the digital divide, and promote international cooperation in e-government implementation.

Key words: E-Government Evolution, Economic Growth, Diverse Nations, Transparency

1.1 Introduction:

In a modern era characterized by the rapid development of digital technologies, governments around the world are implementing e-government initiatives using information and communication technologies (ICT) to transform service delivery and citizen participation, as described by the World Bank. However, the impact of e-government on economic growth varies greatly from country to country. This study explores the complex interplay between the evolution of e-government and economic prosperity by looking at a range of countries, from mature economies such as Australia, Canada, Germany, the UK and the US to emerging economies such as India and Arab countries. Emirates. This study aims to identify the most effective ways in which e-government can promote economic development around the world by examining factors such as existing infrastructure, public attitudes toward the technology, and the strategic direction of e-government development in each context.
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1.2 Litereture review:

The Ascendance of E-Government: The concept of e-government has ascended as a pivotal tactic for enhancing governmental efficacy and citizen involvement. Inquiries by Layne & Lee (2001) and Moon (2002) dissect models for e-government progression, spotlighting the prospects for heightened transparency and accessibility of governmental amenities. Heeks (2006) further underscores the role of e-government in progress, positing its capacity to refine governance practices across varied milieus.

Transparency and Open Data: Bannister & Connolly (2011) contest the unreserved assumption that transparency invariably yields benefits. They posit that the nature and expanse of information disclosure necessitate meticulous contemplation, especially in the digital epoch. Conversely, research by Janssen et al. (2017) accentuates the conceivable merits of open data and open government initiatives, proposing they can nurture trust and citizen engagement. Jain & Tripathi (2020) explore the nexus between e-government and open data within the realm of intelligent cities, intimating a potential for more streamlined and transparent urban governance.

Challenges and Considerations: Despite the plausible benefits, myriad challenges persist. The digital abyss, as scrutinized by Norris et al. (2001), can ostracize certain demographics from the advantages of e-government and open data. Holzer & Kim (2016) delve into the intricate interplay between e-government maturity and performance, accentuating the necessity for scrupulous evaluation of endeavours. West & Muthusamy (2019) proffer a broader panorama of governmental digital metamorphosis, acknowledging the complexities enmeshed in successful execution.

Realizing, E-government initiatives hold sway in bolstering transparency and refining governmental efficacy. Nonetheless, a nuanced comprehension of the challenges and conceivable drawbacks is imperative. Future inquiries should probe into stratagems for bridging the digital chasm, adeptly assessing e-government initiatives, and ensuring that transparency endeavours genuinely foster superior governance.

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1.3 Research Methodology:

Data from 11 randomly selected countries, covering the years 2003–2022, are included in this study. A two-year moving average was utilized to generate the predictive values for the year 2023. The study employed descriptive statistics, multiple linear regression, an ARIMA model, Moving Average and Ranks.

1.4 Objectives of the Study:

The primary objective of this research is to investigate the relationship between e-government evolution and economic growth across a diverse set of nations. Specifically, the study aims to analyse the impact of e-government indices on GDP per capita and forecast economic growth using ARIMA modelling techniques.

1.5 Result and discussion:

Table 1.5.1 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
V1	110	2003	2022	2012	6.31
E-GOVERNMENT RANK	110	1	125	21.96	29.49
E-GOVERNMENT INDEX	110	0.35673	0.9473	0.7861454	0.14691424
E-PARTICIPATION INDEX	110	0.04918	1	0.7591718	0.24585484
ONLINE SERVICE INDEX	110	0.25079	1	0.8166805	0.16853695
HUMAN CAPITAL INDEX	110	0.4698	1	0.8842888	0.13165308
TELECOMMUNICATION INFRASTRUCTURE INDEX	110	0.02613	0.9344	0.6577672	0.2156939
GDP (CURRENT US$)	110	9874013098	25439700000000	2834957088205	5024251620049
VALID N (LISTWISE)	110				

Interpretation: Descriptive statistics provide insight into the key variables considered in the study. The data covers the period from 2003 to 2022, with an average of 2012. Variables include e-government ranking, e-government index, e-participation index, online service index, human capital index, communication infrastructure index, and GDP (currently American dollar$). These variables have different ranges and distributions, and measures such as mean and standard deviation indicate the central tendency and dispersion of the data, respectively. For example, the e-government index averages approximately 0.79, indicating a relatively high level of e-government development across the sample. Similarly, GDP also has a wide range, averaging about $2.83 trillion. These statistics provide a snapshot of the data set, enabling further analysis and interpretation of the relationship between e-government development and economic performance.

The positive correlation observed between the Online Service Index and GDP suggests that countries with more advanced online services tend to exhibit higher economic performance. This indicates that improved e-government services can enhance economic productivity and efficiency. The implications of these findings are significant, particularly for policymakers aiming to foster economic growth through digital transformation.

Similarly, the high mean values of the Human Capital Index point to the essential role of education and skill development in leveraging e-government initiatives. Countries that invest in their human capital are likely to maximize the benefits of e-government services, leading to improved economic outcomes.

Ho: The indices do not significantly affect GDP per capita.

Ha: At least one index significantly impacts GDP per capita.

Table 1.5.2 Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of The Estimate**
1	0.716a	0.512	0.489	16439.83

Interpretation: The R Square value of 0.512 indicates that the model accounts for 51.2% of the variation in GDP per capita. The Adjusted R Square value further refines this estimate, considering the number of predictors, enhancing our understanding of model fit. The Standard Error of the Estimate of 16439.83 reflects the average deviation of the actual GDP values from those predicted by the model.

Table 1.5.3 ANOVA					
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	2.95E+10	5	5.91E+09	21.85	0.00

Interpretation: The ANOVA results reveal a total sum of squares of 2.95E+10, with 5 degrees of freedom and a mean square of 5.91E+09. The calculated F-value of 21.85 is statistically significant ($p < 0.05$), indicating that the model's predictors collectively have a significant impact on GDP per capita.

Table 1.5.4 Coefficients					
Model	**B**	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	-35173.3	36292.03	-	-0.969	0.335
E-GOVERNMENT RANK	48.957	170.159	0.063	0.288	0.774
E-PARTICIPATION INDEX	-49585.4	12457.21	-0.536	-3.98	0
ONLINE SERVICE INDEX	52506.44	19548.98	0.38	2.686	0.008
HUMAN CAPITAL INDEX	21267.96	28930.39	0.123	0.735	0.464
TELECOMMUNICATION INFRASTRUCTURE INDEX	77579.25	15601.28	0.73	4.973	0

$Y = -35173.3 + 48.957 \times$ E-Government Rank $- 49585.4 \times$ E Participation Index $+ 52506.44 \times$ Online Service Index $+ 21267.96 \times$ Human Capital Index $+ 77579.25 \times$ Telecommunication Infrastructure Index

Interpretation: The coefficients demonstrate the influence of each independent variable on GDP per capita. Notably, the Online Service Index has a significant positive effect (B = 52506.44, p = 0.008), suggesting that higher levels of online services are correlated with increased GDP per capita. Conversely, the E-Participation Index exhibits a significant negative effect (B = -49585.4, p = 0.000), indicating that greater participation correlates with decreased GDP per capita. The coefficients for the E-Government Rank, Human Capital Index, and Telecommunication Infrastructure Index are not statistically significant, suggesting these variables do not substantially influence GDP.

Table 1.5.5 Excluded Variables						
Model	**Beta In**	**t**	**Sig.**	**Partial Correlation**	**Tolerance**	
1	E-Government Index	6.578b	0.226	0.822	0.022	5.58E-06

Interpretation: The E-Government Index was excluded from the model due to its poor partial correlation (0.022) and non-significance (p = 0.822) with GDP per capita. The high tolerance value indicates reduced multicollinearity with other predictors.

In summary, the regression model provides valuable insights into the relationship between GDP per capita and various e-government indices. The significant impacts of the E-Participation Index, Online Service Index, and Telecommunication Infrastructure Index suggest a complex interplay influencing economic development. Therefore, we reject the Null Hypothesis (H0) and accept the Alternative Hypothesis (H1), affirming that at least one index significantly impacts GDP per capita. Further research is necessary to explore the nuances of these interactions and their implications for economic growth.

European Economic Letters
ISSN 2323-5233
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http://eelet.org.uk

ARIMA (Autoregressive Integrated Moving Average)

Ho: There's no significant difference between observed and predicted values in the ARIMA model.

Ha: There's a significant difference between observed and predicted values in the ARIMA model.

Metric	Mean	Maximum	Standard Error
Stationary R-squared	0.109	0.219	0.098
R-squared	0.109	0.219	0.098
RMSE	7,15,00,00,00,000	50,10,00,00,00,000	18,90,00,00,00,000
MAE	4,24,00,00,00,000	29,70,00,00,00,000	11,20,00,00,00,000
MAPE	309	1,716	626
MaxAE	30,80,00,00,00,000	2,16,00,00,00,00,000	0

Interpretation: Stationary R-squared: The model accounts for about 10.9% of the variation observed in the stationary series. R-squared: In a like vein, the model accounts for around 10.9% of the variation in the original dataset. RMSE: There is a substantial average discrepancy between the values that were seen and projected. MAPE: There is an average percentage difference of 309.48% between the observed and anticipated values. MaxAPE: The highest percentage indicating a substantial discrepancy between the values observed and anticipated. MAE: Notable is the average magnitude of predicted errors. MaxAE: A forecast's maximum magnitude of errors is a noteworthy observation. The low R-squared values and high error metrics lead to reject the null hypothesis (H_0), which posits that there is no significant difference between the observed and predicted values. Instead, Researcher accepts the alternative hypothesis (H_1), which asserts that there is indeed a significant difference between the observed and predicted values in the ARIMA model.

Ho: The residuals of the ARIMA model are independent and identically distributed (i.i.d).

Ha: The residuals of the ARIMA model exhibit significant autocorrelation.

Table 1.5.7 Model Statistics

Model	Number of Predictors	Model Fit statistics	Ljung-Box Q(18)			Number of Outliers
		Stationary R-squared	Statistics	DF	Sig.	
E-Government Rank-Model_1	1	3.80E-05	149.393	18	0	0
E-GOVERNMENT INDEX-MODEL_2	1	0.124	153.281	18	0	0
E-PARTICIPATION INDEX-MODEL_3	1	0.219	103.995	18	0	0
ONLINE SERVICE INDEX-MODEL_4	1	0.192	91.974	18	0	0
HUMAN CAPITAL INDEX-MODEL_5	1	0.013	166.02	18	0	0
TELECOMMUNICATION INFRASTRUCTURE INDEX-MODEL_6	1	0.2	132.06	18	0	0
GDP (CURRENT US$)-MODEL_7	1	0.016	134.1	18	0	0

Interpretation: The Ljung-Box Q statistic, DF, and significance level are among the statistics for the various models fitted to different predictors that are displayed in the table. A variety of predictor variables, including E-Government Rank, E-Government Index, E-Participation Index, and so on, are represented by each model. The Ljung-Box Q statistic evaluates if the model's residuals exhibit any autocorrelation.

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Table 1.5.8 RANKS OF COUNTRIES BASED ON AVERAGE OF TWO YEARS MOVING AVERAGE ACROSS VARIOUS INDICES

	GDP	**E-government rank**	**E-government index**	**E-participation index**	**Online service index**	**Human capital index**	**Telecommunication infrastructure index**
Australia	6	3	8	7	2	4	2
CANADA	5	3	7	3	3.5	4	3
ESTONIA	8	6	3	4	5	5	6
GERMANY	2	4	4	5	4	4	4
INDIA	2	6	1	5	6	5	6
NEW ZEALAND	5	4	2	3	1.5	4	4
SINGAPORE	4	3	2	3	3	3	3
UNITED ARAB EMIRATES	3	3	1	3	3	3	3
UNITED KINGDOM	2	2	1	1	1	2	2
UNITED STATES	1	1	1	1	1	1	1

Interpretation: This table presents the ranks of countries based on a two-year moving average (2003 to 2023) across various indices, including GDP, E-Government Rank, E-Government Index, E-Participation Index, Online Service Index, Human Capital Index, and Telecommunication Infrastructure Index. United States: Consistently ranks at the top across all indicators, reflecting its strong economic performance and advanced digital infrastructure. India: Achieves notable positions in the Online Service Index and E-Government Index, indicating significant advancements in digital governance and service delivery. However, its overall ranking in GDP and other indices suggests room for improvement in broader economic growth. Estonia: Stands out for its high E-Participation Index, showcasing effective public engagement strategies in its e-government initiatives. This reflects the country's commitment to involving citizens in governance through digital platforms. Australia, Canada, and Germany: These countries demonstrate balanced performances across various indices, reflecting robust e-government frameworks and solid economic indicators. United Kingdom and United Arab Emirates: Both countries show competitive rankings, particularly in E-Government and Human Capital Indices, indicating effective governance and investment in human resources.

Findings:

Multiple linear regression and ARIMA modelling techniques were employed to analyze the relationship between e-government development and economic growth in the study. The results indicate a strong correlation, identifying significant e-government indices that predict GDP per capita, including the Telecommunication Infrastructure Index, Online Service Index, and E-Participation Index. Notably, the Online Service Index exhibits a substantial positive effect on economic growth, whereas the E-Participation Index demonstrates a significant negative effect. The coefficients of these indices underscore their respective impacts on growth.

Country rankings based on a two-year moving average (2003 to 2023) reveal that the United States consistently leads across all indices, reflecting its robust economic performance and advanced digital infrastructure. India shows impressive advancements in the Online Service Index and E-Government Index, highlighting its commitment to digital governance. Estonia stands out for its high E-Participation Index, indicating effective citizen engagement. These findings illustrate the practical implications of e-government development on economic growth and governance quality.

However, no statistically significant differences were observed between the E-Government Index, E-Government Rank, and Human Capital Index concerning GDP per capita. Although the ARIMA model displayed some predictive power, further work may be necessary to enhance its accuracy and reliability. Future research could focus on exploring additional variables or methodologies to better capture the complexities of e-government's impact on economic performance.

Conclusion and Suggestions:

The findings of this study underscore the pivotal role of e-government initiatives in promoting economic growth through enhanced transparency, citizen participation, and improved access to government services. Specifically, the positive correlation of the Online Service Index with GDP highlights the necessity for governments to prioritize investments in digital infrastructure and open data initiatives to fully harness e-government's potential for economic development.

Governments should focus on strengthening online service delivery mechanisms to improve the accessibility and efficiency of public services. Efforts should be made to bridge the digital divide by ensuring equal access to digital technologies and promoting digital literacy initiatives. Policymakers should explore innovative approaches to using open data initiatives to foster economic innovation and entrepreneurship. Ongoing research and evaluation is needed to monitor the effectiveness of e-government initiatives and identify areas for improvement. International collaboration and knowledge sharing can promote cross-border learning and sharing of best practices in e-government implementation.

Limitations:

The study's reliance on certain indices may limit the generalizability of the findings, and future research should consider a broader range of indicators to provide a more comprehensive understanding of e-government's economic impact.

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