



WHETHER A HIGHER E-GOVERNMENT DEVELOPMENT INDEX MEANS A HIGHER GDP GROWTH RATE?

Aziza Usmanova

Department of International Business Administration, Tashkent State University of Economics
aziza.usmanova2909@gmail.com

ABSTRACT

The aim of the paper is to investigate empirically how GDP growth rate is affected by the development of e-government, using data from 193 countries, over the period 2008–2018. Initially, correlation analysis, followed by panel data analysis was used to conduct our research. The results provide evidence that GDP growth rate decreases as e-government development index increases. Yet, sub-indexes of this index affect variously the rate of GDP growth: whereas index of human capital contributes to the GDP improvement, remained indexes affect GDP negatively. Index of e-participation has insignificant effect on GDP.

CCS CONCEPTS

• e-government; • e-government development index; • GDP; • human capital index; • unemployment rate; • online service index; • tax revenue; • telecommunication infrastructure index; • inflation rate; • agriculture; • industry;

ACM Reference Format:

Aziza Usmanova. 2021. WHETHER A HIGHER E-GOVERNMENT DEVELOPMENT INDEX MEANS A HIGHER GDP GROWTH RATE?. In *The 5th International Conference on Future Networks and Distributed Systems (ICFNDS 2021)*, December 15, 16, 2021, Dubai, United Arab Emirates. ACM, New York, NY, USA, 6 pages. <https://doi.org/10.1145/3508072.3508168>

1 INTRODUCTION

In the last decade, the improvement of the e-government sphere has become actual for governments around the globe. There have been adopted different policy strategies and even laws to introduce and enhance the e-government system in many countries including Uzbekistan.

E-government can be described as “a system of online rendering state services to the public and business” [22]. E-Government Survey is conducted every two years to measure and compare e-government introduction and improvement among 193 countries. This comparison is held using Index of E-government Development which is composed of three sub-indexes. These indexes illustrate the overall statement of the country in implementing e-government statement.

E-government has also been under the focus of scholars. Different approaches and views are presented on researches dedicated

to investigating effects of e-government on many spheres. Some authors conduct research on how the e-government can help in combating corruption [1–3], others investigate its contribution to sustainable development [4–7], as well as its role in decreasing shadow economy [8] and alleviating tax evasion [9].

In publications of the United Nations [22] it is discussed that “e-government has a big potential for governments, enhancing its transparency to the public”.

Nevertheless, to our knowledge, as e-government is a relatively new field of study, there is not much empirical study with recent data investigating how growth rate of GDP is affected by e-government improvement. Thus, our purpose is to reveal the effects of e-government on economic growth using the method of panel data analysis. Interestingly, our empiric analysis results contradict the common theoretical approach about positive association between these variables. Our results have become unexpected, as theoretically the e-government development should serve to the improvement of economic growth, yet our findings contradict this assumption. Firstly, we how GDP is influenced by e-government development index (EGDI), after which we observed how each sub-index affects GDP. The only sub-index having a positive effect on GDP is index of human capital (HCI).

This paper consists of five sections. Section 2 covers investigations conducted on this subject till this time. Data used in our research as well as explanation of methodology are given in Section 3. Results of our analysis are presented in Section 4. Conclusion from our investigation is provided in the last Section 5.

2 LITERATURE REVIEW

There are different approaches to investigating how public sector is affected by improvement of e-government. It has been estimated that in solving certain issues in different spheres e-government can be a powerful instrument. Investigations held on analyzing the role of e-government in solving issues of informal economy [8] revealed that it is a strong mechanism in declining informal business. Moreover, it was revealed that long-run effects of e-government are much stronger than short-run ones.

An interesting approach has been done in investigating e-governance where it has been analyzed whether countries are matured to the e-government [10, 11]. In their research, they attempted to measure the maturity of e-government. They represented it as “demonstrated behavior” consisting of three components, namely GDP, human capital and infrastructure of ICT. Their findings supported perspective focused on infrastructure, claiming that maturity of e-government is at a different level among countries. If the country is richer and has good ICT infrastructure, its e-government improvement is better.

Azad, Bijan, et. al., 2010 [12] conducted research on how authority institutions impact on the spreading rate of e-government. They

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

ICFNDS 2021, December 15, 16, 2021, Dubai, United Arab Emirates

© 2021 Association for Computing Machinery.

ACM ISBN 978-1-4503-8734-7/21/12...\$15.00

<https://doi.org/10.1145/3508072.3508168>

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP (%)	1123	3.627	5.45	-46.082	123.14
Taxes to GDP (%)	761	17.576	8.878	0	149.284
Inflation rate (%)	1034	5.983	15.574	-3.9	379.848
Unemployment rate (%)	1068	7.665	5.723	.11	33.76
Agriculture (%)	1071	11.317	11.219	.028	65.175
Industry (%)	1074	26.676	12.794	1.305	84.349
Population growth rate (%)	1154	1.428	1.502	-4.537	16.476
EGDI	1158	.474	.215	0	.946
HCI	1158	.696	.222	0	1
OSI	1158	.414	.264	0	1
TII	1158	.319	.247	0	1
EPI	1158	.337	.29	0	1

concluded that human capital and governance influence insignificantly on maturity of e-government maturity.

Moreover, they found out that in formation of e-government corporate governance transparency, press freedom, democratic practices, and corruption perception, which represent individual institutional characteristics of every country, play crucial and positive role. Interestingly, in their analysis, they found out that the association between economic growth and e-government enhancement is insignificant.

Uyar, A., et.al., 2021 made research on the influences of the e-government on alleviating tax evasion and concluded that in reducing tax evasion and increasing tax revenue one of powerful mechanisms is e-government.

Various studies are investigating how economic growth is affected by inflation, but overall, all these researches can be divided into two schools: researchers assuming that GDP suffers from inflation [13–16] and researchers assuming that inflation has a positive effect on GDP [17–20].

The level of development of a country's economy in a market economy depends, among many other factors, on its tax policy. During implementation and development of tax policy, the consequences of this process might have different effect on economic growth. Therefore, the country can achieve macroeconomic efficiency through tax policy.

Over the years, various theories have emerged explaining how taxes affect economic development, yet all of them agree that economic growth is stimulated by taxes. The debates between theories are held on the matter of the period of effects of tax policy on economic. In accordance with Keynes's growth model, taxes have a favorable and long-term effect on economic condition, whilst supporters of neoclassical model claim that this outcome is short-term.

3 DATA AND METHODOLOGY

In our research panel data of 193 countries between 2008 and 2018 with one-year-interval is analyzed. The data for our analysis is used from E-Government Survey that is conducted by United Nations every two years among 193 countries. That is the reason why our data has one-year-interval. With the help of this survey

it can be identified at what development level are countries in implementation of e-government. This identification is carried out by using indexes. The main index illustrating overall condition of e-government in the country is EGDI, which consists of three sub-indexes, namely the Online Service Index (OSI), Human Capital Index (HCI) as well as Telecommunication Infrastructure Index (TII). Besides, e-participation index (EPI) is also considered as an independent variable in our analysis. These indexes have a range between zero and one, where the higher the indexes are, the quality of e-government is better.

Dependent variable is GDP as our aim is to identify how improvement of e-government influences on the rate of growth of GDP.

As control variables from macroeconomic indicators, we used inflation rate; agriculture (as % of GDP), unemployment rate; tax revenue as % of GDP; agriculture; industry (as % of GDP); and from demographic indicators we used the population growth rate. These data we obtained from the databank of World Bank [23]. In Table 1 overall information about used variables is given.

During panel data analysis five models were created. Model 1 illustrates the effect of EGDI on GDP and Model 5 represents the effect of EPI on GDP, whereas in other models it is analyzed how every sub-index of EGDI affects GDP (Table 2).

In order to conduct analysis for each model, initially Model of Fixed Effects was created, after which the Model of Random Effects was created, among which best model was selected using the Hausman test.

The strength of these models is that they can control both variations among units and variation over time, and they give "more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency" [24]. In the Fixed Effects Model, it is assumed that the individual-specific coefficient β_{1i} is fixed for each subject, that is, it is time-invariant. The formula of the Fixed Effects Model is [25]:

$$Y_{it} = \beta_1 x_{it} + a_i + u_{it} \quad (1)$$

Where:

Y_{it} – dependent variable, where i =country and t =years;

β_1 -independent variable's coefficient;

Table 2: Correlation matrix

Variables	GDP	Tax revenue	Inflation	Unemployment	Agriculture	Industry	Population	EGDI
GDP	1.000							
Tax revenue	-0.096 (0.008)	1.000						
Inflation	-0.032 (0.303)	-0.087 (0.020)	1.000					
Unemployment	-0.126 (0.000)	0.190 (0.000)	0.015 (0.646)	1.000				
Agriculture	0.233 (0.000)	-0.191 (0.000)	0.229 (0.000)	-0.270 (0.000)	1.000			
Industry	0.054 (0.078)	-0.273 (0.000)	0.032 (0.311)	-0.051 (0.109)	-0.336 (0.000)	1.000		
Population	0.181 (0.000)	-0.181 (0.000)	0.024 (0.432)	-0.269 (0.000)	0.270 (0.000)	0.236 (0.000)	1.000	
EGDI	-0.198 (0.000)	0.180 (0.000)	-0.151 (0.000)	0.029 (0.345)	-0.700 (0.000)	0.063 (0.039)	-0.350 (0.000)	1.000

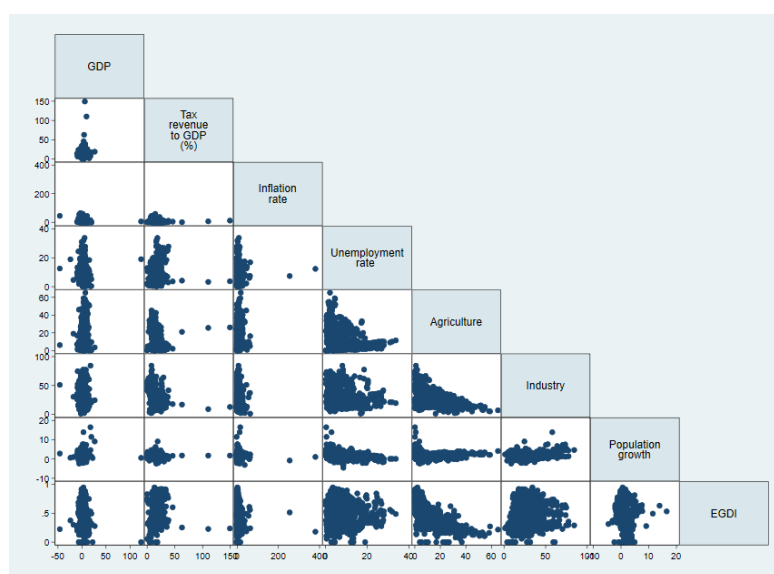


Figure 1: Correlation relationship between variables

x_{it} – independent variable;

$a_i(i=1 \dots 193)$ is the unknown intercept for each country;

u_{it} – error term

The Random Effects Model considers as random component the heterogeneity over individuals and its formula is [25]:

$$Y_{it} = \beta_1 x_{it} + a_i + (u_i + e_{it}) \quad (2)$$

Where:

Y_{it} – dependent variable, where i =country and t =years;

β_1 -independent variable's coefficient;

x_{it} – independent variable;

$a_i(i=1 \dots 193)$ is the unknown intercept for each country;

e_{it} – combined time-series and cross-section component of the error term

u_{it} – cross-section or individual specific error component

In our analysis for all our created models, Fixed Effects Model is chosen according to conducted Hausman test.

4 RESULTS AND DISCUSSION

Conducted correlation analysis between our variables and its outcome is represented in Table 2. The graph form of these results is represented in Figure 1

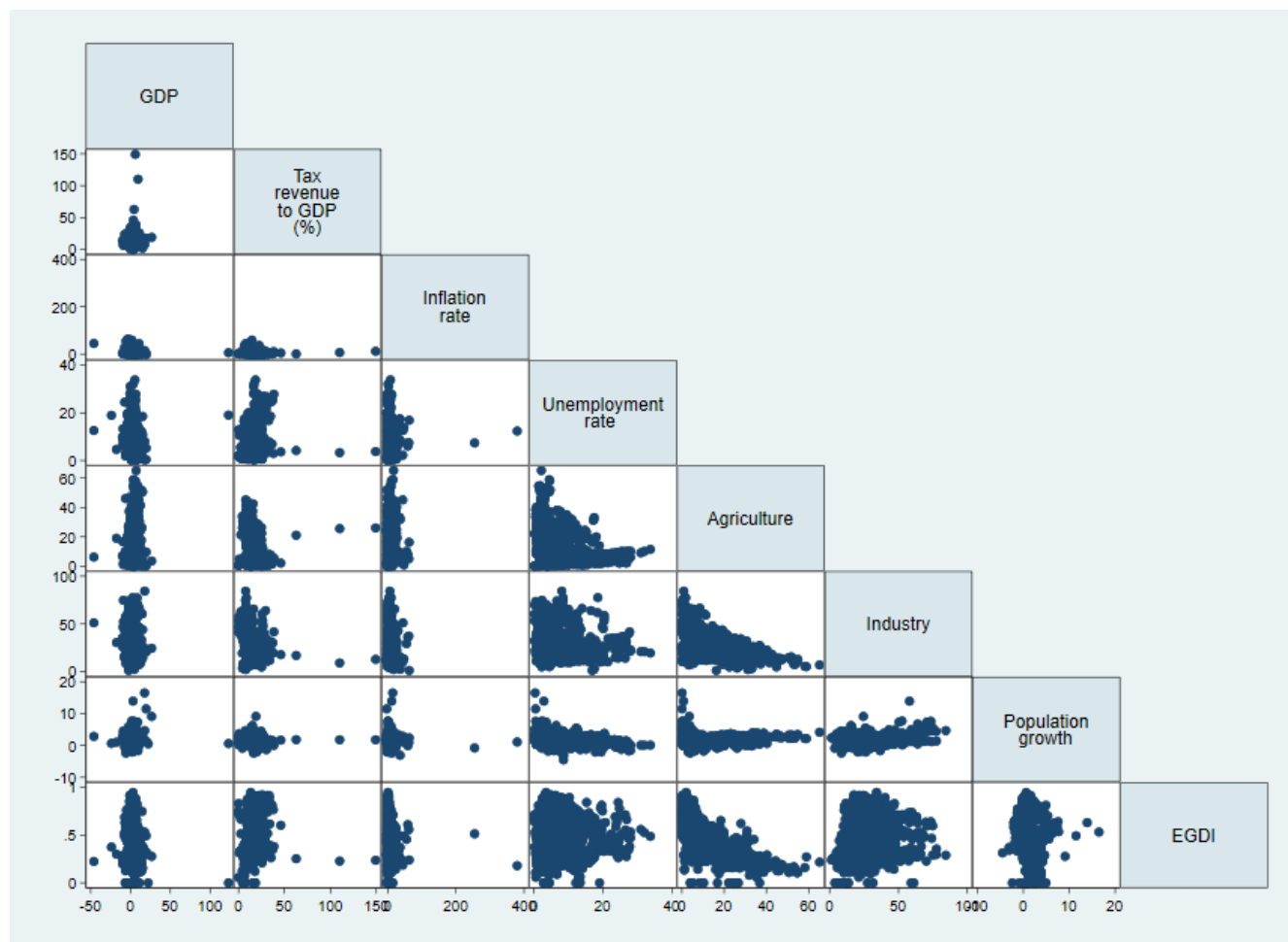


Figure 2: Correlation relationship between variables

It can be seen that GDP correlated negatively and slightly with EGDI (-0.198). GDP has a negative relationship also with tax revenue, inflation, and the unemployment rate. According to these results, GDP correlated positively with agriculture, industry, and population growth rate. Regarding the EGDI, it has a strong and negative relationship with agriculture, whereas the relationship with tax revenue and industry is positive but with small strength.

Figure 2 illustrates how countries are dispersed regarding their GDP around EGDI. From this illustration it can be concluded that countries with higher rate of GDP growth have lower level of EGDI, whereas countries with lower GDP have more advanced EGDI level. In Figure 3 the combination of regression and correlation analysis between GDP and EGDI is represented. Here, it can be seen, most countries with high level of EGDI do not have high rate of growth of GDP.

Table 3 represents economic results for economic growth using the e-government development index and the additional controls. All our models provide the results from estimating Eq. 1). Although in theoretical approaches a positive effect of e-government improvement on GDP is assumed [26–28], our empirical results contradict

these assumptions. Model 1 indicates that EGDI affects adversely GDP. The coefficient is significant at a 5% level and indicates that if EGDI increases by 1 unit, the growth rate of GDP decreases by about 5.0 percentage points.

Next, we analyzed how each sub-index of EGDI affects GDP. In Model 2, we observed how improvement of HCI affects economic growth. At the significance rate of 1% a beneficial effect of HCI on GDP is revealed. This finding is in line with [29]. An increase of HCI by 1 unit increases GDP by 5.99 percentage points. Model 3 shows the influence of OSI on GDP, which is negative, and the coefficient is significant at a 5% level. This indicates that an increase by 1 unit of OSI will decrease the GDP growth rate by nearly 1.78 percentage points. The last sub-index - TII (Model 4) also harms growth rate of GDP (significance level is 1 %), meaning that an increase by 1 unit in - telecommunication infrastructure index will decrease the GDP growth rate by about 5.18 percentage points. Finally, we also created a model of the effect of EPI on GDP but the result is insignificant.

Regarding control variables, they remained relatively stable and significant (apart from population growth rate) in all our models.

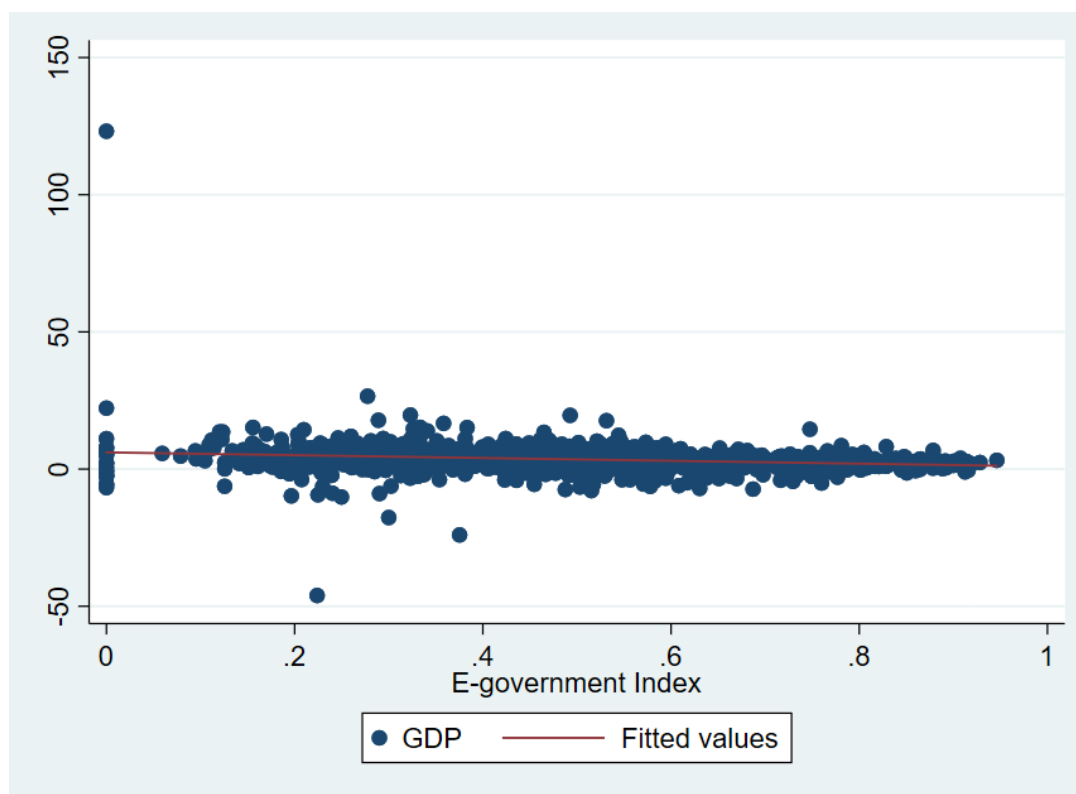


Figure 3: How countries are placed around EGDI accordingly to their GDP growth rate

As suggested by the literature [30], the effect of taxes revenue on GDP is positive (significance level is 1%). An increase by 1 unit of taxes to revenue as % of GDP will increase GDP growth rate by approx. 0.07 percentage points. On the contrary, in line with other researchers' findings [13–16], GDP is affected unfavorably by inflation rate. The coefficient is significant at a 1% level and means that an increase by 1 unit of inflation decreases GDP by about 0.08 percentage points. At the significance level of 5% unemployment rate also affects adversely GDP and its strength is even higher than inflation's impact. GDP growth rate will decline by nearly 0.145 percentage points if the unemployment rate rises by 1%. Agriculture is associated positively with GDP (1% level of significance). An increase in this variable by 1 unit will also increase GDP by about 0.2 percentage points. Industry value added as % of GDP also impacts positively on GDP at the 1% significance level, and GDP will increase by 0.2 percentage points if this indicator increases by 1 unit.

5 CONCLUSION

This paper makes an analysis of panel data of 193 countries between a decade (2008-2018 years) to provide an estimation of the link between EGDI and GDP growth rate. We document that EGDI has a negative and statistically significant effect on GDP, although its sub-indexes have different effects on GDP. So, although both TII and OSI decrease GDP, on the contrary, HCI has positive impact on GDP. Moreover, our macroeconomic variables in the models remained stable and had a significant effect on GDP. Both inflation

rate and unemployment rate influence negatively on GDP, whereas the taxes to revenue as % of GDP, agriculture and industry sectors have a positive effect on GDP.

However, it is important to note that while estimates show that the higher the improvement in EGDI, the lower GDP growth rate, they should not be treated as improvement in the e-government index worsens the economic situation of the country. These results suggest that if the government implements policies aimed at developing an e-government system, it also should be ready for the decline in GDP growth rate.

REFERENCES

- [1] Nasr G. Elbahnasawy, E-Government, Internet Adoption, and Corruption: An Empirical Investigation, *World Development*, Volume 57, 2014, Pages 114-126, ISSN 0305-750X
- [2] Bhatnagar, S. (2003). E-government and access to information (pp. 24–32). United Nations, Global Corruption Report 2003.
- [3] S. Kim, H.J. Kim, H. Lee. An institutional analysis of an e-government system for anti-corruption: The case of OPENGovernment Information Quarterly, 26 (1) (2009), pp. 42-50 networks. In *Proceedings of the IEEE 1st International Conference on Broadnets Networks (BroadNets'04)*. IEEE, Los Alamitos, CA, 210–217.
- [4] Elbahnasawy, N. G. (2014). E-Government, Internet Adoption, and Corruption: An Empirical Investigation. *World Development* Vol. 57, pp. 114–126.
- [5] United Nations (2008). UN e-government survey 2008: From e-government to connected governance. New York: Department of Economic and Social Affairs.
- [6] Niebel, T. (2018). ICT and economic growth—Comparing developing, emerging and developed countries. *World Development*, 104, 197–211.
- [7] Twizeyimana, J. D., & Andersson, A. (2019). The public value of E-Government—A literature review. *Government information quarterly*, 36(2), 167–178.
- [8] Elbahnasawy, N. G. (2021). Can e-government limit the scope of the informal economy?. *World Development*, 139, 105341.

Table 3: Linear panel data regression analysis with time fixed effect

Variable	1	2	3	4	5
Tax revenue	.07429565*** (0.0221362)	.07972686*** (0.0221426)	.07639476*** (0.0222143)	.07282955*** (0.0219501)	.07390731*** (0.0222512)
Inflation	-.08255465*** (0.0255262)	-.08908594*** (0.0256521)	-.0793604*** (0.0254829)	-.09770479*** (0.0257838)	-.07884206*** (0.0259213)
Unemployment	-.15297099** (0.0602479)	-.15229483** (0.0598221)	-.15433299** (0.0607289)	-.14928693** (0.0593476)	-.14056454** (0.0608327)
Agriculture	.25254559*** (0.0815444)	.25244998*** (0.080134)	.2655571*** (0.0812902)	.21244996*** (0.0814733)	.29116877*** (0.0818782)
Industry	.29379033*** (0.037553)	.26501946*** (0.039461)	.29732602*** (0.0375549)	.25836362*** (0.0389183)	.30137741*** (0.0384091)
Population growth rate	0.145 (0.2802307)	0.110 (0.2798679)	0.153 (0.2807555)	0.091 (0.278456)	0.182 (0.2813243)
EGDI	-5.0152824** (2.006361)				
HCI		5.9945996*** (1.900509)			
OSI			-1.7832425** (0.8674271)		
TII				-5.1786172*** (1.313446)	
EPI					-0.446 (0.5653826)
_cons	-3.6550956* (2.165446)	-10.121987*** (1.719589)	-5.7387324*** (1.748242)	-2.990 (1.89152)	-6.89631*** (1.718077)

- [9] Uyar, A., Nimer, K., Kuzey, C., Shahbaz, M., & Schneider, F. (2021). Can e-government initiatives alleviate tax evasion? The moderation effect of ICT. *Technological Forecasting and Social Change*, 166, 120597.
- [10] Singh, H., Das, A., & Joseph, D. (2007). Country-level determinants of e-government maturity. *Communications of the association for information systems*, 20(1), 40.
- [11] Das, A., Singh, H., & Joseph, D. (2017). A longitudinal study of e-government maturity. *Information & Management*, 54(4), 415-426.
- [12] Azad, Bijan, et. al. "What Shapes Global Diffusion of e-Government: Comparing the Influence of National Governance Institutions." *JGIM* vol.18, no.2 2010: pp.85-104.
- [13] Arai M., M. Kinnwall, and P.S. Thoursie. (2002). "Cyclical and casual patterns of inflation and GDP growth", Working paper, department of Economics, Stockholm University.
- [14] Fischer, S. (1993). The role of macroeconomic factors in economic growth. *Journal of Monetary Economics*, 32, 1-87.
- [15] Barro, Robert J. (1995). "Inflation and economic growth", NBER Working Paper 5326.
- [16] Gillman M., M. Harris, and L. Matyas. (2002). "Inflation and growth: Some theory and evidence", Berlin: 10th International Conference on Panel Data.
- [17] Sarel, M. (1996). Nonlinear effects of inflation on economic growth. *IMF Staff Papers*, International Monetary Fund, 43, 199-215.
- [18] Ghosh, A., and S. Phillips. (1998) "Inflation, disinflation, and growth", *IMF Working Paper*, May.
- [19] Khan, M. S., & Senhadji, A. S. (2001). Threshold effects in the relationship between inflation and growth. *IMF Staff Papers*, 48(1), 1-21.
- [20] Mubarik, Y. A. (2005). Inflation and growth: An estimate of the threshold level of inflation in Pakistan. *SBP-Research Bulletin*, 1(1), 35-44.
- [21] Karagianni, S., Pempetzoglou, M., & Saraidaris, A. (2012). Tax burden distribution and GDP growth: Non-linear causality considerations in the USA. *International Review of Economics & Finance*, 21(1), 186-194.
- [22] United Nations E-Government Survey 2008, 2010, 2012, 2014, 2016, 2018
- [23] World Bank (2018). World Development Indicators. <https://datacatalog.worldbank.org/>
- [24] Gujarati, D. N. (2011). *Econometrics by example* (Vol. 1). New York: Palgrave Macmillan.
- [25] Adkins, L. C. (2011). *Using Stata for principles of econometrics*. Wiley Global Education.
- [26] Khan, F. N., & Majeed, M. T. (2020). ICT and e-Government as the sources of economic growth in information age: Empirical evidence from South Asian economies. *South Asian Studies*, 34(1).
- [27] Ali, M.A., Hoque, M.R. and Alam, K. (2018), "An empirical investigation of the relationship between e-government development and the digital economy: the case of Asian countries", *Journal of Knowledge Management*, Vol. 22 No. 5, pp. 1176-1200. <https://doi.org/10.1108/JKM-10-2017-0477>
- [28] Majeed, M. T., & Malik, A. (2016). E-government, financial development and economic growth. *Pakistan Journal of Applied Economics*, 26(2), 107-128.
- [29] Pelinescu, E. (2015). The impact of human capital on economic growth. *Procedia Economics and Finance*, 22, 184-190.
- [30] Babatunde, O. A., Ibukun, A. O., & Oyeyemi, O. G. (2017). Taxation revenue and economic growth in Africa. *Journal of accounting and taxation*, 9(2), 11-22.
- [31] *stments on Capital Markets: 10th Capital Market Effective Investments Conference / Publisher: Springer International Publishing / 2019*