



An Empirical Analysis of Economic Performance of Asian Economies: The Role of Electronic Government

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ABSTRACT

Information and communication technology (ICT) plays a key role in explaining the growth patterns of an economy. Many of Asian economies have exhibited high growth patterns in recent years. What explains economic performance of Asian economies? Does implementation of ICT in public sector matters for the growth of Asian economies? To answer this question, this study analytically explores and empirically tests the linkages of ICT in public sector with economic performance reusing the panel data of 34 Asian economies over the period 2003-2015. For empirical analysis, this study uses Fixed Effects, Random Effects, and System Generalized Method of Moments (SGMM) estimation techniques. The empirical results show that e-government plays a positive and significant role in economic performance of the Asian economies. This finding remains robust even after controlling the effects of trade, government consumption and inflation.

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1. Introduction

Asia is a fast growing region of the world and its dynamic economies lead global growth. However, high growth patterns of Asian economies are not homogenous across the region. Asian economies such as China, India and Bangladesh are fast growing while some economies such as Pakistan, Kiribati, Nepal and Fiji are exhibiting slow growth rates. What are the fundamental factors of large differences in economic performance across Asian economies? Why do some economies produce high and sustained growth and others do not? This question has received much attention of the economist and policy makers and many causes of growth have been identified but still much of growth remains unexplained. Recently, researchers have focused on information and communication technology as a potential cause of growth differences.

The literature on causes of growth has largely shown favorable effects of ICT. For example, Levine (1997) asserts that ICT facilitates information access that improves investment and growth. Quah (2002) points out that ICT improves broad based education, labor skills and consumer sophistication. Moreover,

increasing use of ICT enhances labor productivity and as a result economic growth increases.

Recently, the concept of e-government and its linkages with economic development have attracted the attention of economists and policy makers. E-government is defined as the use of information and communication technology by government for “delivering and sharing” of information and better services to the people (Chen *et al.* 2009; Krishnan and Teo, 2012). E-government adoption increases economic development through increasing accountability and transparency (Bhatnagar, 2003; OECD, 2005; UNDP, 2006).

Theory suggests a number of mechanisms through which e-government increases economic development. First e-government enhances the quality of services and responsibilities of public sector (Al Kibsi *et al.*, 2001; Von Haldenwang, 2004; and West, 2004). Second, it strengthens the role of public and democracy (Von Haldenwang, 2004; and West, 2004). Third, it helps to mitigate corruption and other malpractices in the society by assuring transparency and accountability (Tirole, 1996; Haigh, 2004; Mishra, 2006; Haigh and Griffith, 2008; Krishnan and Teo, 2012).

In spite of significant importance of e-government for various economic and social indicators, the empirical literature has virtually ignored the relationship of economic performance and e-government for Asian economies. Does e-government explains growth performance of Asian economies. To our knowledge, this question is not yet addressed. There are some country specific studies which cannot be generalized for the region of Asia. This study contributes into the empirical literature on causes of growth in Asian economies by providing empirical evidence of the links of growth with e-government. The empirical analysis is based on panel data of Asian economies and the results are obtained using Fixed Effects, Random Effects, and System Generalized Method of Moments (SGMM) estimation techniques.

Rest of the paper is organized as follows: Section 2 provides relevant literature and explains the links of e-government with economic growth. Section 3 describes the data and Section 4 explains empirical framework used for the study. Section 5 provides a discussion on empirical findings. Section 6 concludes the paper.

2. E-government and Economic Performance

Information and communication technology (ICT) is a potential source of economic efficiency and research has largely shown its positive effects on economic performance (Quah, 2002; Levine, 1997). The research on ICT has been recently focusing on ICT implementation in public sector which is referred as e-government. For instance Ma *et al.*, (2005) shows that an initiative of e-government in China is causing economic development through increasing transparency and decentralization of administration.

What are the potential links which explain the impact of e-government on economic growth? E-government boosts economic growth through various channels. Lack of transparency in public services is one of the potential sources which inhibit economic performance of an economy. In this regard, e-government helps to overcome this barrier by combating corruption. An implementation of e-government enhances transparency and accountability and probability of corruption decreases.

In the presence of e-government interactions between government officials and citizens tend to decrease, thereby lowering the discretionary power of government officials. E-governments helps to eliminate information asymmetries by increasing quality and quantity of information which enables the citizens to question the arbitrary and unfair decisions by public officials, thereby increasing accountability, transparency and lowering corruption. Thus e-government helps to eradicate many opportunities of corruption (OECD, 2005; Piatkowski, 2006). Consequently, e-government enhances economic growth by lowering corruption. In a recent study, Majeed and Malik (2016), in a sample of 143 economies, found evidence that e-government helps to reduce corruption. According to World Bank (2001), corruption is the largest single obstacle to economic development and growth process of an economy. Therefore, to

have a sustainable and rapid economic growth elimination of corruption and its roots is fundamental.

Another mechanism through which e-government promotes economic growth is the quality of relationships between government and citizens. An implementation of ICT tools in public sector improves relationships between government officials and citizens. For example Welch et al. (2005) argued that availability of government websites improves the citizens' satisfaction from government and they trust on government. Similarly, Tolbert and Mossberger (2006) suggested that government can build citizen's trust on government through efficient provision of services using e-government. However, some studies argue that e-government does not help to build citizen's trust on government. For example, using the survey data of 214 government website users for Singapore Teo et al. (2008) found that trust is built by the effectiveness of government policies rather than the use of technology.

Another mechanism through which e-government can enhance economic performance is reduction in climate degradation. In the presence of e-government movement of people and transport tend to reduce, thereby reducing the burden on environment. For example, using a sample of 105 countries from 2004-2008, Krishnan et al. (2013), found that the effect of e-government on economic growth is mediated by reduction in corruption and environmental degradation.

E-government can facilitate growth related activities by overcoming information asymmetries between economic agents and government for economic interactions. An improvement in quality of information and diffusion of knowledge facilitates production activities. Another way through which e-government can increase economic growth is the productivity of public officials. ICT tools help to increase productivity of labor and other inputs, thereby cost of production falls and production increases. For example, Mahyideen et al. (2012), in a sample of 5 ASEAN economies over the period 1976- 2010, found that ICT improves economic growth by improving the productivity of labor and other inputs and lowering the cost of production. Using a panel data of 217 countries, Choi and Yi (2009) found that one percent increase in internet subscription leads to 0.05 percent increase in economic growth. Similarly, using the panel data of OECD countries from 1996 to 2007, Czernichet et al. (2011) supported the positive association between broadband and growth

Bhuiyan (2010) asserts the importance of e-government for Kazakhstan. He argues that e-government is contributing into development process of Kazakhstan by lowering the red tape cost, increasing control for corruption, reducing administrative and monitoring costs, lowering disguised employment, improving local and international relations, strengthening social cohesion and fostering economic growth. Using a panel data of 44 African countries from 1988-2007, Andrianaivo and Kpodar (2011) found positive impact of ICT infrastructure on economic growth.

One strand of the literature opposes the development of ICT infrastructure in the case of developing economies. The basic argument is that developing economies need to take care of the provision of basic health services, electricity and clean water instead of diverting scarce resources from basic services toward the provision of ICT infrastructure (see Ngwenyama et al., 2006; Morawczynski and Ngwenyama, 2007). The success of ICT infrastructure largely depends on the availability of complimentary factors such as technical staff, finance to maintain various costs associated with ICT systems. For example, maintenance cost and upgrading costs are the intrinsic features of ICT systems. Similarly, some research studies have shown reservations in adopting e-government in the case of developing economies. Kumar et al. (2007) proposed that the factors which affect adoption of e-government are different from other technologies. The e-government adoption is driven by socio-economic, traditional, culture, normative and human issues. The adoption of e-government needs a huge amount of investment on ICT and broadband and sometime it precludes the investment on other important sectors like education, health among others.

We can conclude from the literature review that literature on e-government and economic growth is emerging in recent years. Most of the studies provide theoretical links and do not provide empirical

analysis. In addition the literature largely focuses on developed economies or country specific studies. The empirical literature generally focuses on ICT rather than implementation of ICT in public sector. The literature on ICT merely focuses on internet whereas internet is one component of e-government. The concept of e-government is rather border then the mere use of internet in empirical analysis. E-government is a broader measure that includes all information and communication technologies, web structure, and skilled labor that helps in the functioning of e-government. Asia is a fast growing region as it is leading world economic growth. Does e-government explain economic growth of Asian economies? To our knowledge this question is not addressed. This study contributes in the literature on ICT and growth using a panel data of Asian economies. Moreover, this study takes care of the issue of endogeneity. This study tests the following research hypothesis.

H0: E-government does not explain economic growth of Asian economies.

H1: E-government causes positive effect on the growth of Asian economies.

3. Empirical Model

The empirical model for this study is based on Cobb-Douglas production function of Mankiw, Romer and Weil(1992).The production function comprises three inputs that are labor, physical capital and human capital.

$$Y_{it} = A_{it} L_{it}^{\alpha_{it}} K_{it}^{\beta_{it}} H_{it}^{\gamma_{it}} \quad (1)$$

Where i refers to cross sectional units that are Asian countries in our sample t represents time period of the study. By taking the natural log of the equation 1 we have equation 1.1

$$\log y_{it} = \log A_{it} + \gamma_1 \log L_{it} + \gamma_2 \log K_{it} + \gamma_3 \log H_{it} \quad (1.1)$$

Where A is a given state of technology in a country, y stands for real per capita GDP growth, L stands for labor force participation, K stands for capital stock, and H stands for human capital. Technological growth is a key driver of economic performance of an economy. Following Czernichet *al.* (2009) we have assumed that technology evolves exponentially over time which can be shown as follows:

$$A_i = A(0)e^{\theta_{it}} \quad (2)$$

Taking log of equation 2 gives us

$$\log A_{it} = \log A_0 + \theta_{it} \quad (2.1)$$

θ shows technological growth of a country. Suppose that e-government boosts up the technological progress in a country through ICT by facilitating spillover of knowledge, R&D and production of new technologies, so θ can be defined as:

$$\theta_{it} = \alpha_1 + \alpha_2 E_government_{it} \quad (3)$$

Substitution equation 3 in equation 2.1

$$\log A_{it} = \alpha_0 + \alpha_1 + \alpha_2 E_government_{it} \quad (3.1)$$

$$\text{Where } \alpha_0 + \alpha_1 = \gamma_0$$

$$\log A_{it} = \gamma_0 + \alpha_2 E_government_{it} \quad (2.2)$$

By substituting equation 2.2 in equation 1.1 we have equation 1.3

$$\log y_{it} = \gamma_0 + \alpha_2 E_government_{it} + \gamma_2 \log L_{it} + \gamma_3 \log K_{it} + \gamma_4 \log H_{it} + e_{it} \quad (1.3)$$

Following Barro (1991), in order to check convergence hypothesis, we have incorporated initial GDP per capita into equation 1.3 as a determinant of economic growth.

$$\log y_{it} = \gamma_0 + \gamma_1 Y_{it-1} + \gamma_2 E_government_{it} + \gamma_3 \log labor_{it} + \gamma_4 \log capital_{it} + \gamma_5 \log human - capital_{it} + \gamma_5 \log X_{it} + \epsilon_{it} \quad (1.4)$$

Equation 1.4 is the final equation which is estimated using panel data estimators. X_{it} is a matrix of control variables which includes trade openness, government final consumption and inflation.

4. The Data Description

To estimate the impact of e-government on economic growth, this study uses unbalanced panel data of Asian economies. All countries belonging to Asia were short listed for empirical analysis. However, some of the countries do not have observations on e-government and therefore after data screening we are left with 34 economies. Economic performance is measured using natural of GDP per capita at 2005 constant prices. Following the literature of endogenous growth models, this study uses following control variables: initial GDP per capita, physical capital formation, human capital formation, labor force and e-government. The effect of trade openness, government final consumption and inflation is also incorporated during sensitivity analysis of the baseline findings.

The index of e-government is based on three components. The first component is ‘web connection and online service’. This component measures the extant of web content approachability of an economy. Moreover, it measures evolving online presence in websites which expands information provision through arranging multimedia contents, online transaction service and interactions of citizens with government. The second content is ‘telecommunication service’. This component comprises fixed telephone, mobile telephone, number of personal computers and the number of internet users. Finally, the fourth component is ‘human capital’. This component is based on the rate of adult literacy and gross enrollment of primary, secondary and tertiary education. The index of e-government is developed using weighted average of these three components and it ranges from 0 to 1. The value of 0 implies absence of e-government and the value of 1 implies full presence of e-government.

Table 4.1 reports summary statistics of the data used for empirical analysis. The lowest value of GDP per capita is 696 which belongs to Afghanistan while the highest value of GDP per capita is 55838 which belongs to Singapore. The quality of e-government on average in Asian country is 0.40 which is relatively low. However, there are differences across Asian countries. Some countries have zero level of e-government such as Kiribati and some have the highest values such as Korea has 0.8785. Table 4.2 reports correlation matrix of the variables used for empirical analysis. E-government has positive and high correlation with GDP per capita. Moreover, all components of e-government have positive correlation with GDP per capita.

Table 4.1: Summary Statistics of the Data

Variables	Observations	Mean	Std. Dev.	Min	Max
Y	344	9277	12091.9	696.6	55838.63
Labor	312	64.54615	8.661987	38.6	85.1
Capital	287	25.05979	8.646833	8.041532	63.04872
Human Capital	255	78.95593	26.08619	13.18077	154.8082
E-government	292	.3998195	.1991774	0	.8785
Inflation	344	6.853444	7.244612	-22.09025	59.73974
Trade	344	100.5652	62.57655	24.25	433.05
Government Exp	344	16.44151	13.02356	3.57	55.25
Urban	336	14.50032	2.263721	9.595399	18.56387
Fix_telephone	326	15.08325	15.10355	.02	58.91
Online service	300	.308733	.2357369	0	1
Telecom Infra	298	.1514594	.1990489	0	.7098

Table 4.2: Correlation Matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Y	1.0000											
2. Labor	-0.0756	1.0000										
3. Capital	-0.1736	0.0876	1.0000									
4. HC	0.6434	-0.1378	-0.0055	1.0000								
5. E-gov.	0.7232	-0.1286	0.0310	0.7338	1.0000							
6. Inflation	-0.2926	0.0718	-0.0711	-0.0541	-0.2866	1.0000						
7. Trade	-0.1163	0.0560	-0.0815	-0.0465	-0.0349	0.0968	1.0000					
8. Gov-Con	-0.1438	-0.2859	0.1435	-0.2505	-0.4197	-0.0237	0.0083	1.0000				
9. Urban	-0.0019	0.0525	0.0073	0.2510	0.1064	0.1060	-0.0172	-0.1547	1.0000			
10. Fix_tele	0.7905	-0.1547	0.0291	0.7531	0.8852	-0.3268	-0.1849	-0.3120	0.0533	1.0000		
11. online	0.5652	-0.1745	0.0634	0.4795	0.8854	-0.2949	-0.1068	-0.3990	0.0906	0.7226	1.00	
12. Telecom	0.8106	-0.1563	-0.0179	0.6792	0.9106	-0.3509	-0.1218	-0.3121	0.0399	0.9301	0.7898	1.00

To test the presence of multicollinearity among independent variables, the VIF (Variance Inflating Factor) test is used (Table A2). The values of VIF for individual indicator and mean value for all indicators are less than 10 implying that there is not a serious issue of multicollinearity in our model. The lowest value of VIIF is 1.03 while highest value of VIF is 2.34 and average value of VIF is 1.93. The functional form of the model is tested applying Link test (Table A3). The results reported in Table conform that functional of the model is correct as P-value of hat square is 0.11. Figure 1 presents a graphical relationship between e-government and economic growth of Asian countries. It is quite clear from figure that the relationship is positive and linear implying that e-government is positively associated with GDP per capita in the Asian region.

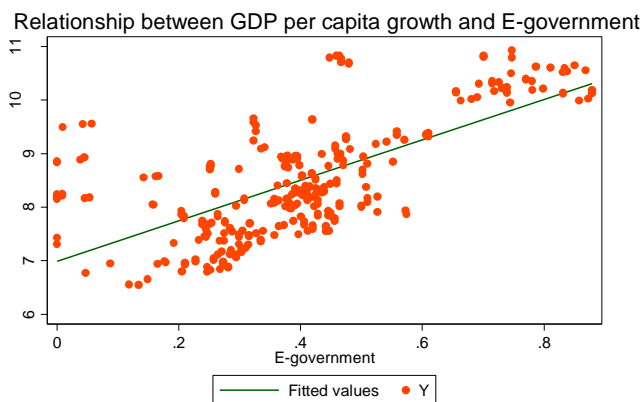


Figure 1

Figure 1: Economic Growth and E-government

5. Empirical Findings

The empirical results are estimated using fixed effects model. The fixed effects model is superior to OLS because it controls country specific time invariant characteristics. Furthermore, it also captures unobserved heterogeneity by estimating intercept for each cross sectional unit in the panel data. Baltagi (2008) argues OLS yields biased parameter estimates when panel data set comprises time invariant characteristics while fixed effects model gives unbiased results. Since Asian economies are heterogeneous and comprise time invariant characteristics, fixed effects model is more appropriate as compared to OLS.

Table 5.1 provides fixed effects results for e-government and economic growth of Asian economies. Column (1) indicates that the effect of e-government on economic growth is positive and significant. In

particular, one unit increase in e-government causes 0.14 percent increase in GDP per capita growth in developing economies. This effect remains robust in remaining regression results reported in Table 5.1.

Table 5.1: E-government and Economic Growth: Fixed Effects Models

VARIABLES	Empirical Results of Fixed Effects Model			
	(1)	(2)	(3)	(4)
Y_{t-1}	0.800*** (0.0304)	0.800*** (0.0302)	0.799*** (0.0312)	0.802*** (0.0303)
Labor	-0.355*** (0.132)	-0.411*** (0.136)	-0.352*** (0.134)	-0.359*** (0.132)
Capital	0.0468** (0.0218)	0.0334 (0.0230)	0.0473** (0.0221)	0.0443** (0.0218)
Human Capital	0.0893*** (0.0336)	0.0979*** (0.0338)	0.0889*** (0.0339)	0.0926*** (0.0336)
E-government	0.144* (0.0764)	0.138* (0.0760)	0.143* (0.0769)	0.141* (0.0762)
Trade		0.0560* (0.0330)		
Gov. Consumption			0.00550 (0.0361)	
Inflation				0.000710 (0.000507)
Constant	Constant	2.613*** (0.615)	2.613*** (0.611)	2.600*** (0.623)
Observations	168	168	168	168
R-squared	0.899	0.901	0.899	0.900
Number of country	34	34	34	34

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

To assess the robustness of growth effect of e-government, we include additional growth determinants one by one. In columns (2-4) we have incorporated trade, government consumption and inflation, respectively. The growth impact of trade turns out to be positive and significant implying that trade is an important source of economic performance of Asian economies. This finding is consistent with a number of empirical studies on trade and growth (see Majeed, 2015). Column 3 includes government consumption as an additional control variable. The role of government consumption turns out to be insignificant. Column 4 includes inflation as an indicator of macroeconomic instability. The effect of inflation also turns out to be insignificant.

The advantage of fixed effects model is that it captures time invariant characteristics of crosssectional units. However, it does not control the effects of random shocks in error terms. Moreover, fixed effects may worsen the problem of multicollinearity due to dummy variables trap. We also use random effects model. Table 5.2 reports empirical results of growth and e-government using random effects model. Column 1 indicates that the effect of e-government on economic growth of Asian economies is positive and significant. The parameter estimate on e-government indicates that one unit increase in adoption of e-government cause 0.13 percent increase in economic growth. This effect remains robust in remaining columns of Table 5.2.

Table 5.2: E-government and Economic Growth: Random Effects Models

VARIABLES	Empirical Results of Random Effects Model			
	(1)	(2)	(3)	(4)
Y_{t-1}	0.966***	0.965***	0.966***	0.968***
	(0.0103)	(0.0104)	(0.0103)	(0.0104)
Labor	-0.0144	-0.0197	-0.0150	-0.0181
	(0.0499)	(0.0511)	(0.0518)	(0.0501)
Capital	0.0329*	0.0325*	0.0329*	0.0324*
	(0.0168)	(0.0170)	(0.0169)	(0.0168)
Human Capital	-0.00598	-0.00657	-0.00603	-0.00742
	(0.0217)	(0.0220)	(0.0217)	(0.0217)
E-government	0.129**	0.134**	0.128**	0.126**
	(0.0578)	(0.0586)	(0.0610)	(0.0578)
Trade		0.0105		
		(0.0144)		
Gov. Consumption			-0.000581	
			(0.0125)	
Inflation				0.000794
				(0.000528)
Constant	0.258	0.241	0.261	0.257
	(0.227)	(0.235)	(0.244)	(0.228)
Observations	168	168	168	168
Number of country	34	34	34	34

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Since our endogenous growth model has a lag dependent variable on the right side, fixed effects and random effects methods may give biased results. In this case system GMM is more efficient and reliable. Furthermore, it addresses the issue of endogeneity in the model using instruments for endogenous variables (Baltagi, 2008). Since installation of e-government requires huge cost, it may depend on GDP per capita. In this situation reverse causality problem will arise. Comin and Hobjin (2004) point out that twenty famous technologies of the world were initially adopted by developed countries. It implies that developed economies have enough resources to manage the costs of these technologies. To maintain causality from e-government to GDP per capita growth, we use Arrelano-Bond (AB) model. We use both internal and external instruments to address the issue of endogeneity. Internal instruments are own lag variables of endogenous variables while external instruments are fixed telephone lines and initial urban population. Fixed telephone lines as instrument for broadband was used by Czernichet *al.* (2011). Since broadband access depends on cable, TV and fixed telephone lines, it is highly correlated with fixed telephone lines. Urban density theory suggests that fixed costs of ICT infrastructure decrease as urbanization increases because the availability of complimentary tools of ICT becomes widespread and knowledge spill overs (Anderson, 2008).

Table 5.3 reports the results of e-government and economic growth using AB model. All columns of the model indicate that the impact of e-government on economic growth is robustly positive and significant. Thus baseline findings remain intact.

Table 5.3: E-government and Economic Growth: Arrelano Bond

VARIABLES	Empirical findings of Arrelano Bond Model			
	(1)	(2)	(3)	(4)
Y_{t-1}	0.924*** (85.59)	0.921*** (84.02)	0.924*** (85.16)	0.934*** (75.73)
Labor	-0.0555 (-0.695)	-0.115 (-1.305)	-0.0548 (-0.544)	-0.0727 (-0.870)
Capital	0.0592*** (2.603)	0.0549** (2.407)	0.0592** (2.545)	0.0590** (2.496)
Human Capital	0.0409** (2.224)	0.0272 (1.339)	0.0410** (2.006)	0.0187 (0.837)
E-government	0.312*** (4.721)	0.356*** (4.966)	0.312*** (4.654)	0.307*** (4.467)
Trade		0.0194 (1.548)		
Gov. Consumption			0.000165 (0.0117)	
Inflation				0.00164* (1.916)
Constant	0.413 (1.165)	0.659* (1.703)	0.409 (0.835)	0.487 (1.316)
Observations	157	157	157	157
Number of country	33	33	33	33

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

The use of ICT is growing in all spheres of life and its usage has changed the way people communicate, work and live. ICT lowers information barriers, reduces transaction costs, and increases efficiency of the workers. The available literature on ICT has identified merits of ICT for growth and development. Does ICT implementation in public sector help to boost the growth of an economy? This question has received less attention. In particular, the region of Asia which is a fast growing region has been ignored in empirical literature on growth and ICT.

This study contributes in ICT and growth literature by empirically investigating the growth effects of ICT implementation and adoption in public sector using a panel data of Asian economies from 2003 to 2015. To measure ICT in public sector, this study uses a novel measure of e-government from the United Nations that covers multiple dimensions of e-government. Estimation techniques take care of the country specific fixed and random effects. Moreover, to address the potential problem of endogeneity System GMM method of estimation is used.

The empirical results of study show that e-government contributes positively and significantly in the growth performance of Asian economies. The parameter estimate on e-government suggests that one unit increase in e-government increases economic growth of Asian economies by 0.14 percent. This finding remains robust to different specifications, alternative econometric techniques and endogeneity problem. This finding implies that government of Asian economies aiming at high and sustainable growth needs to adopt ICT infrastructure in public sector to fulfill its responsibilities. Another robust finding of our analysis suggests that human capital is a strong and robust determinant of growth in Asia. This finding implies that investment in human capital is critical in Asian economies. Moreover, investment in human capital can offset the loss of employment created by the adoption of e-government.

Though empirical findings are aligned with prior theoretical expectations, this analysis has certain limitations. First, Asian economies are quite heterogeneous in terms of socioeconomic and cultural factors and therefore, adoption of e-government for some economies may not ensure economic prosperity. Second, adoption of e-government requires huge implementation costs which may not be feasible for Asian economies at lower level of economic development. The data set for all Asian countries were not available, therefore, these findings cannot be generalized for the whole region and developing world. In addition, the sensitive analysis for this study is very limited.

Future research needs to extend this study for different sub-regions in the Asia. The sensitivity analysis needs to be extended using more factors of growth. This study mainly focuses on positive aspects of e-government ignoring its potential downsides. For instance, the consequences for income distribution need to be studied. Similarly effects on labor market needs to be analyzed.

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Appendix:

Table A1: Summary of Variables

Variables	Definition	Source
Economic Growth	Natural log of the GDP per capita at 2005 constant prices.	[1]

E-government	Extent of online availability of the government, telecom infrastructure, and human capital.	[2]
Online service	Extent of the online availability of the government.	[2]
Telecom service	Extent of telecom infrastructure of the government.	[2]
Human capital	Gross secondary school enrollment of total population.	[3]
Physical capital	Gross fixed capital formation in percentage of GDP.	[3]
Labor force	Share of labor force participation in total population.	[3]
Government Consumption	Government spending in the share of Gross domestic product at 2005 constant prices	[1]
Urban population	Natural log of Urban population	[3]
Fix_Telephone	Fixed telephone lines per 100 inhabitant	[4]

Sources: [1]Penn World Tables (version 7.1); [2] Global E-governance Reports; [3] World Development Indicators (2014); [4] International Telecommunication Union (2014)

Table A2: Variance Inflating Factor

Variable	L.Y	E-government	Labor	Capital	Human Capital
VIF	2.34	3.09	1.03	1.14	2.04
1/VIF	0.427350	0.323235	0.971980	0.876506	0.491118
		Mean VIF	1.93		

Table A3: Linktest

Y	Coef.	Std. Err.	T	P>t	[95% Conf. Interval]
_hat	1.075286	.0476114	22.58	0.000	.9812796 1.169292
_hatsq	-.0042897	.0027076	-1.58	0.115	-.0096357 .0010563
_cons	-.3242146	.2062253	-1.57	0.118	-.7313953 .0829661

Figure A1: Marginal Effect of E-government on GDP per Capita of Asian Economies

