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Impact of e-government on Foreign Direct Investment in East and Southeast Asia

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ABSTRACT

Purpose: This empirical study investigates the relationship between e-government and inward foreign direct investment (FDI) in East and Southeast Asia. E-government or electronic government refers to the applications of information and telecommunication technologies to provide public services and information to the citizens. In theory, e-government initiatives may positively influence FDI.

Design/methodology/approach: A panel of twelve countries in the region, covering a period between 2003 and 2020, is employed for empirical analysis. Static panel regression methods are applied to estimate the effect of e-government on foreign direct investment of the host countries.

Findings: E-government is found to have a positive and statistically significant impact on FDI inflows. This result is robust to heteroskedasticity, autocorrelation, and cross-sectional dependence, and remains consistent under different specifications.

Research limitations/implications: E-government initiative is an important and viable channel to attract foreign direct investment to the host countries in the region. Regarding this objective, the countries may concentrate on improving telecommunication infrastructure and online services.

Originality/value: This paper is the first empirical attempt to explore the relationship between e-government and foreign direct investment in East and Southeast Asia. It also contributes significantly to the limited empirical studies in the existing literature.

Keywords: Foreign direct investment, E-government development, Location advantages, East and Southeast Asia

I. Introduction

As one of the major channels for international technology and knowledge diffusion (Nguyen & Park, 2021), Foreign Direct Investment (FDI) is an important economic development driver (Teeramungcalanon et al., 2020). FDI is a form of long-term investment

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† Corresponding author: Huy Le VU E-mail: huy.vule@vimaru.edu.vn by foreign investors that may contribute directly more capital to the host countries for growth, and enable technology transfer from the home countries (Vu et al., 2022). FDI is also a source of capital that may be considered stable and less susceptible to financial crises (Jadhav, 2012; Soh et al., 2021). A country may seek FDI for the enhancement of innovation capacity (Li et al., 2020). Jehangir et al. (2020) found both short-run and long-run positive effects of FDI on economic growth. Hence, FDI is desirable and expected to facilitate industrializing

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progress and structural transformation in host countries (Adhikary, 2010; Soh et al., 2021).

Most of countries in Southeast Asia are the members of the Association of Southeast Asian Nations (ASEAN). Jointly, ASEAN is the fifth largest economy (ASEAN Secretariat, 2021) and has the third biggest labor force (Lee et al., 2019). Three countries in East Asia, China, Japan and South Korea are among the top global economies. According to the data from World Bank, China and Japan were the second and the third largest economies in the world, and South Korea ranked tenth (World Bank, 2020). East and Southeast Asian economies are highly integrated (Korwatanasakul, 2022), and together, they create one of the most dynamic economic regions (Kirk et al., 2016; Teeramungcalanon et al., 2020). In 2019, total trade between ASEAN and the three East Asian countries were more than US\$890 billion, or nearly one third of ASEAN's total merchandise trade (ASEAN Secretariat, 2020).

While FDI is a pronounced important driver of developing countries, there are several reasons for the advanced economies in the region, such as Japan, South Korea, and Singapore may also seek to increase inward FDI. The argument that inward FDI may improve employment, output and productivity, can be applied to the developed countries (Driffield, 2001; Driffield & Girma, 2003). As an indicator of openness, inward FDI may lead to growth in the host country (Kimino et al., 2007). FDI inflows are necessary for sustainable development in developed countries (Saini & Singhania, 2018). A country with possession of abundant skilled labor like South Korea, can capitalize the technology-related FDI (Eichengreen et al., 2012). Therefore, exploring determinants of FDI in East and Southeast Asian is an attractive research topic.

While several economic, institutional, and political determinants of FDI have been identified, the effect of information and communication technologies (ICTs) on FDI attraction is getting more attention. The spread of new ICTs has transformed the global system and evidence of the roles of e-government in attracting FDI has been well documented (Al-Sadiq,

2021; Gholami et al., 2006; Tiong et al., 2022). E-government is an adoption of ICT in providing public services to citizens, investors, and other stakeholders (Ho, 2002). More specifically, an e-government strategy is to implement the Internet and the World Wide Web for the delivery of information and civil services (Kim & An, 2022). The adoption of ICTs and web-based telecommunication technologies is expected to improve the efficiency and effectiveness of public services. E-government initiatives may reduce transparency, and improve efficiency and accessibility of information for investment, hence potentially making the host countries more appealing in the eyes of FDI investors.

There have been very few attempts to empirically examine the relationship between e-government and FDI attraction of host countries in general, and no study in the context of East and Southeast Asia so far. Thus, this study aims to answer whether the East and Southeast Asian countries can acquire more FDI inflows via the development of e-government. Based on a panel of 12 countries in the region, covering a period from 2003 to 2020, a consistent and significant positive effect of e-government on FDI attraction is found under different regression methods and model specifications.

II. Literature Review

The eclectic paradigm of international production was first introduced in 1976, and has become a seminal framework for FDI studies. It provides a comprehensive view on the drivers of both initial act and growth of foreign production by multinational enterprises (henceforth MNEs) (Dunning, 1980, 1988). Despite of some criticisms, the eclectic paradigm is one of the most useful frameworks to explore the behavior of individual MNEs, especially in terms of FDI decision and implementation (Kang & Jiang, 2012; Tiong et al., 2022).

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The eclectic paradigm consists of three pillars: Ownership, Location, and Internalization advantages (for this reason, it is also known as OLI paradigm), and they are interdependent. The second pillar or the location-specific advantages directly relate to where MNEs choose to place their overseas production facilities. FDI attractiveness of a specific location depends on the economy, social and political conditions of the host country (Al-Sadiq, 2021). Many studies have used this approach to explore potential determinants of FDI (Kang & Jiang, 2012; Tiong et al., 2022; Saini & Singhania, 2018).

E-government is a concept of providing public services more efficiently and effectively to citizens and businesses via the application of ICTs (UN, n.d.). Initially, the e-government initiative is a strategy that employs digital means such as the Internet and the World Wide Web to improve the efficiency of government agencies and enable online government service (UN & ASPA, 2002). The concept hitherto has evolved to open mass interactions with stakeholders, and make government data available, toward the creation of an innovation-constructing government based on ICTs. Theoretically, as a potential enhancement of location-specific advantages, the e-government development of host countries may have a direct and indirect influence on inward FDI.

Development of e-government can reduce the foreign investors' transaction cost (Kachwamba, 2011) and positively improve the institutional quality of the host countries. Particularly, there are three channels that e-government can influence the inward FDI flows. At first e-government can significantly improve performance and efficiency of administrative processes regarding international investment license and operation, hence directly reduce foreign investors' costs and time. Secondly, as e-government can facilitate foreign investors to explore investment opportunities by providing various information and knowledge on economic, political and institutional conditions of the potential host country, it can reduce information costs and indirect investment barriers (Al-Sadiq, 2021; Bekaert, 1995). Lastly, overall effect of e-government initiative can improve effectiveness and transparency of the government

whereby corruption might be mitigated (Mistry & Jalal, 2012). Corruption is believed to have negative impact on FDI (Habib & Zurawicki, 2002; Javorcik & Wei, 2009). Being a prospective tool to counter corruption, e-government can promote inward FDI inflows.

In the current literature, the effect of e-government on FDI is an understudied topic while major focus is on the other determinants through the lens of the OLI paradigm and institutional theory (Kim & An, 2022). There are also very few empirical evidences on the foregoing relationship. To the best of my knowledge, the only exceptions are Al-Sadiq (2021), and Kim and An (2022). In the former study, the author employed a panel of 178 countries, covering the 2003-2018 period, and found a significant effect of e-government development on FDI inflows. The issue with the finding is that the author only controlled for heteroskedasticity by using robust standard errors in fixed effects and random effects regressions. In this typical microlevel panel, the presences of heteroskedasticity, autocorrelation, as well as cross-sectional dependence are all expected. The author also did not control for time-specific effects; therefore, the result might be biased because of global shocks that affected both FDI and e-government development during the sampling period. In the later study, based on bilateral FDI data of 16 home and 15 host countries from 2014 to 2018, the authors concluded a positive impact of e-government development in host countries on FDI from home countries. In addition, moderating effect of level of corruption on the foregoing relation was found. Because the result was obtained by using logistics regression with binary transformation of the dependent variable, it only provided an estimate of e-government impact on FDI probability. Another issue with the finding is an assumption that the unobservable e-government development levels in a missing year equal the levels in the nearest previous year. Targeting all the discussed gaps and unavailability of empirical study that is dedicated to East and Southeast Asia in the existing literature, the present study finds a statistically significant effect of e-government development on attracting FDI based on data of 12 countries in the foregoing region from 2003 to 2020. The result is robust to specification, heteroskedasticity, autocorrelation and cross-sectional dependence.

III. Methodology

A. Model Specification

The relationship between e-government and FDI in East and Southeast Asia is estimated using the following equation:

$$FDI_{i,t} = \beta_0 + \beta_1 EGO V_{i,t} + x_{i,t}^{'}\beta + \epsilon_{i,t}$$

$$\epsilon_{i,t} = \mu_i + \lambda_t + v_{i,t}$$

where *i* refers to the country subscript $(i = 1, \dots, N)$, *t* refers to the year subscript $(t = 1, \dots, T)$, β s are estimated coefficients, the dependent variable $FDI_{i,t}$ is FDI inflow of country *i* at year *t*, $EGOV_{i,t}$ is e-government development level of country *i* at year *t*, $x_{i,t}$ is a set of control variables suggested by the literature, $\epsilon_{i,t}$ refers to the error term and it can be decomposed into μ_i , λ_t , and $v_{i,t}$. While μ_i is timeinvariant characteristics of country *i*, λ_t refers to universal time-related effects at year *t*, and $v_{i,t}$ is idiosyncratic error term. The objective of this study is to estimate β_1 , or the causal effect of e-government on FDI. β_1 is expected to be positive as e-government hypothetically enhances the host countries' attractiveness to FDI.

The inclusion of control variables inspired by related FDI studies from literature helps to cope with endogenous problems. Employing gross domestic product (GDP) per capita, GDP growth rate, trade openness, and political stability of the host countries, the detailed baseline equation is:

$$\begin{split} FDI_{i,t} &= \beta_0 + \beta_1 EGOV_{i,t} + \beta_2 GDPC_{i,t} \\ &+ \beta_3 GDPG_{i,t} + \beta_4 OPEN_{i,t} + \beta_5 POST_{i,t} \\ &+ \mu_i + \lambda_i + v_{i,t} \end{split}$$

where $GDPC_{i,t}$ refers to GDP per capita, $GDPC_{i,t}$

is GDP growth rate, $OPEN_{i,t}$ is trade openness, $POST_{i,t}$ is political stability of country *i* at year t. The presences of GDP per capita and GDP growth rate in the equation are controls for development and potential of the host markets (Al-Sadiq, 2021; Anwar & Nguyen, 2010; Chiappini & Viaud, 2021; Hsiao & Shen, 2003; Jadhav, 2012). The institutional quality of the host countries is controlled by political stability (Kang & Jiang, 2012; Teeramungcalanon et al., 2020). Trade openness measures how much the host economy is open to international trade, and presents the policy framework (Al-Sadiq, 2021; Kang & Jiang, 2012; Saini & Singhania, 2018; Xaypanya et al., 2015). GDP per capita, GDP growth rate, trade openness, and political stability are all expected to have positive impact on FDI inward flows to the host countries.

B. Data

E-government development index (EGDI) published by the United Nations Department of Economic and Social Affairs (UN DESA) is the measure for $EGOV_{i,t}$, the key explanatory variable in this study. It is computed by three sub-indexes: online service index (OSI), human capital index (HCI), and telecommunication infrastructure index (TII) (United Nations, 2020). EGDI is the most reliable measurement of e-government with concrete and transparent methodology, hence it is a pronounced choice of proxy.

The data of FDI inflows, GDP per capita, GDP growth rate, and trade openness are collected from World Bank's World Development Indicators (WB WDI) dataset. The index of political stability and absence of violence from World Bank Worldwide Governance Indicators (WB WGI), is selected to represent the explanatory variable of political stability. In this study, FDI inflows and GDP per capita data are transformed into natural logarithms to ease skewness and mitigate heteroskedasticity in error variance (Soh et al., 2021).

A panel of ten countries in Southeast Asia, and two East Asian countries, covering a period between 2003 and 2020, is formed to investigate the link between e-government development and FDI in East and Southeast Asia. The panel is unbalanced due to the availability of the key variable data as UN DESA has only published EGDI in 2003, 2004, 2005 and once every two years since 2008. All the Southeast Asian countries are member states of ASEAN, including Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. Two countries in East Asia are South Korea and Japan. Following Halaszovich et al. (2020), China is excluded because of extreme outlier problem.

As shown in Table 1, the lowest value of EGOV is 0.187 (Myanmar in 2014), while the highest value is 0.956 (South Korea in 2020). There is a wide dispersion of e-government development in the region. South Korea, Japan and Singapore have the highest values of EGOV and always among the top 20 globally. Especially, South Korea were the most developed e-government in 2010, 2012, and 2014, and ranked 2nd in 2020. In contrast, Lao PDR, Myanmar, and Cambodia are the least developed e-governments in the region. Values of EGOV in these countries were lower than the average level of Asia in 2020.

Table 1. Data d	lescription
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Pairwise correlations of variables are provided in Table 2.

C. Panel Analysis Strategy

As the panel is small in both dimensions: the number of waves (T=10) and the number of cross-sectional units (N=12.), following (Soh et al., 2021), the static panel methods are employed. Particularly, pooled ordinary least squares (POLS) estimator is the first applied method, then following estimators are fixed effects (FE) and random effects (RE). Under a condition that there is no time-invariant heterogeneity, POLS may provide the most efficient and unbiased estimate. However, if there is a presence of time-invariant heterogeneity, POLS estimate is biased and fails to capture causal effects.

Both FE and RE estimators can control for timeinvariant heterogeneity but in different ways. By subtracting cross-sectional unit-specific means from both dependent and independent variables, the FE model removes between-unit heterogeneity (Allison, 2012; Brüderl & Ludwig, 2014). Therefore, the FE

Variable	Obs	Mean	Std. Dev.	Min	Max
FDI (log)	117	21.95365	1.811066	16.64384	25.1197
EGOV	120	0.5483322	0.2133875	0.18694	0.956
GDPC (log)	120	8.651848	1.427197	6.082359	11.02474
GDPG	120	4.673136	4.076152	-9.518295	14.51975
OPEN	114	117.4922	89.65212	11.8554	437.3267
POST	120	-0.029273	0.9217636	-2.095395	1.495759

Note: FDI and GDPC data are logarithm transformed.

Table 2.	Correlation	matrix
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	FDI	EGOV	GDPC	GDPG	OPEN	POST
FDI	1					
EGOV	0.6584	1				
GDPC	0.4428	0.8439	1			
GDPG	-0.1652	-0.4972	-0.504	1		
OPEN	0.3318	0.2831	0.337	0.1405	1	
POST	0.2168	0.5266	0.7504	-0.3302	0.4117	1

estimator is robust to time-invariant unobserved heterogeneity. FE approach is equivalent to the least square dummy variable (LSDV) estimator, or in other words, using POLS with the inclusion of unit-specific constants. The drawback of the FE model is its inability to estimate the effect of time-invariant variables.

The second estimator that is robust to time-invariant heterogeneity is the RE model. However, in this approach, the unit-specific error term is treated as a random variable and one additional assumption, in comparison with the FE model, is no correlation between the unit-specific error term and the independent variables. On one hand, this assumption is really strong. On the other hand, it can provide estimates of time-invariant variables while the FE model cannot.

The choice of estimators depends on a certain set of conditions. First, Breusch and Pagan Lagrangian multiplier (BP ML) test can suggest a selection of RE or POLS (Saini & Singhania, 2018). If the null hypothesis of this test is rejected, RE is the more appropriate estimator. Second, F-test for poolability can signal applicability of FE model over POLS in case that the null hypothesis is rejected. Finally, between FE and RE estimators, the Hausman's model specification test can help to decide (Hausman & Taylor, 1981; Saini & Singhania, 2018; Soh et al., 2021). In addition to applicability of the specific estimators, the time-specific effects are controlled by the employment of dummy variables for global financial crisis and Covid-19. Two time-invariant dummy variables are included to control for landlock country (the case of Lao PDR), and small country (the case of Brunei Darussalam).

In order to check the present of heteroskedasticity, Breusch-Pagan/Cook-Weisberg (BP/CW) test is performed. As heteroskedasticity is common in microlevel panel data, the null hypothesis of constant variance is likely to be rejected. Conducting Wooldridge test helps to detect possible first-order autocorrelation in the panel. To deal with heteroskedasticity and autocorrelation, most empirical studies apply robust standard errors (only heteroskedasticity-consistent) or cluster standard errors (both heteroskedasticity and autocorrelation-consistent) (Hoechle, 2007). However, using robust or cluster standard errors cannot ensure the validity of estimates if there is a presence of cross-sectional dependence. Many empirical studies of FDI ignore cross-sectional dependence (Al-Sadiq, 2021; Asongu et al., 2018; Kim & An, 2022). As the result of the Pesaran's test for cross-sectional dependence (CSD) (Pesaran, 2004; Wursten, 2017) shows that most of independent variables are not cross-sectional independent. Driscoll and Kraav's (1998) standard errors are applied. This type of standard errors is not only heteroskedasticity and autocorrelation-consistent, but also robust to general forms of cross-sectional dependence (Hoechle, 2007). Especially, in the case of a small sample with the presence of cross-sectional dependence similar to this study, Driscoll and Kraay standard errors perform better than the alternative covariance estimators.

Further regressions are conducted under different specifications in order to investigate the robustness of the estimated effect of e-government on FDI. Urban population growth (Patra, 2019; Poelhekke & Ploeg, 2009) or inflation rate (Al-Sadiq, 2021; Kim & An, 2022), or fixed broadband subscriptions per 100 people are added to the underlying model to check whether the estimates are sensitive to changes in specifications or not. These additional models are estimated using FE and RE estimators, and Driscoll and Kraay standard errors.

The analysis is extended to investigate the different effects exerted by the components of e-government development on FDI. The key independent variable is replaced by each component, OSI, HCI, and TII sequentially, and all of them in these further regressions, using Driscoll and Kraay standard errors and inclusion of the above-mentioned time-invariant and time-specific dummies.

IV. Results and Discussion

Table 3 shows the results using the POLS estimator. The estimated effect of e-government on the dependent variable is statistically significant or insignificant in different regression scenarios. The presence of timeinvariant unobserved heterogeneity in the error terms is suspected, as the GDP per capita coefficient is negative but significant in some cases. The sign of political stability is also unexpectedly negative. Thus, FE or RE estimator might be able to provide valid estimation since time-invariant heterogeneity is controlled.

As presented in Table 4 the coefficient of e-government is consistently positive and statistically significant in both FE and RE models and in different scenarios of time-invariant and time-specific dummies. In terms of control variables, across the table, the signs of both GDP per capita and political stability are significant and positive in accordance with the prediction. All the results of the poolability test in columns (1), (3), (5), and (7) significantly reject the null hypothesis, hence implying that FE models are superior to POLS. The BP ML test in columns (2), (4), (6), and (8) conclude the appropriateness of RE

Table 3. Pooled ordinary least squares regressions

models over POLS. Comparing each pair of estimators in each scenario, rejection of the null hypothesis of the Hausman specification test suggests that FE models are more suitable than RE models.

Heteroskedasticity is detected because the null hypothesis of homoskedasticity of BP/CW test (Table 3) is rejected. The result of Wooldridge test with p-value is 0.2609, and fails to reject the null hypothesis of no first-order autocorrelation. Table 5 presents the CSD test and reveals that most of variables are crosssectional dependent. The only exception is trade openness, which is cross-sectional independent. As the presence of heteroskedasticity and cross-sectional dependence weakens the validity of the above estimates using conventional standard errors, it is necessary to apply Driscoll and Kraay standard errors.

The regressions in Table 4 are performed again with the application of Driscoll and Kraay standard errors in Table 6. After controlling for heteroskedasticity, autocorrelation, and cross-sectional dependence, the coefficient of e-government is still statistically significant and positive regardless of using FE or RE estimators and under any scenarios. Hence, the role of e-government development in attracting FDI to host countries in East and Southeast Asia is confirmed. The Hausman specification test still suggests the

VARIABLES	POLS (1)	POLS (2)	POLS (3)	POLS (4)
EGOV	8.216***	1.023	8.380***	0.522
	(1.128)	(1.275)	(1.212)	(1.377)
GDPC	-0.404*	0.462**	-0.432*	0.581**
	(0.220)	(0.214)	(0.248)	(0.241)
GDPG	0.0476	-0.0190	0.0455	0.0141
	(0.0413)	(0.0341)	(0.0570)	(0.0453)
OPEN	0.00380**	0.00174	0.00373**	0.00131
	(0.00159)	(0.00127)	(0.00167)	(0.00134)
POST	-0.211	0.0791	-0.197	0.0682
	(0.219)	(0.176)	(0.223)	(0.178)
Time-invariant effects	-	YES	-	YES
Time-specific effects	-	-	YES	YES
BP/CW test	7.48***	4.24**	7.73***	4.41**
Observations	111	111	111	111

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

VARIABLES	FE (1)	RE (2)	FE (3)	RE (4)	FE (5)	RE (6)	FE (7)	RE (8)
EGOV	2.150* (1.145)	4.142*** (1.268)	2.150* (1.145)	2.832** (1.291)	2.673** (1.280)	4.078*** (1.410)	2.673** (1.280)	2.767* (1.443)
GDPC	2.519*** (0.441)	0.560 (0.346)	2.519*** (0.441)	0.544* (0.315)	2.502*** (0.441)	0.785** (0.371)	2.502*** (0.441)	0.700** (0.344)
GDPG	0.0382 (0.0252)	0.0285 (0.0292)	0.0382 (0.0252)	0.0113 (0.0289)	0.0525 (0.0327)	0.0486 (0.0375)	0.0525 (0.0327)	0.0406 (0.0376)
OPEN	0.000312 (0.00354)	-0.00187 (0.00313)	0.000312 (0.00354)	-0.00232 (0.00259)	-0.00156 (0.00367)	-0.00339 (0.00335)	-0.00156 (0.00367)	-0.00358 (0.00282)
POST	0.667*** (0.242)	0.650** (0.267)	0.667*** (0.242)	0.654*** (0.251)	0.705*** (0.241)	0.712*** (0.265)	0.705*** (0.241)	0.708*** (0.255)
Time-invariant effects	-	-	YES	YES	-	-	YES	YES
Time-specific effects	-	-	-	-	YES	YES	YES	YES
Poolablity test	24.99***	-	24.99***	-	25.56***	-	25.56***	-
BP LM test	-	70.15***	-	18.09***	-	71.16***	-	17.69***
Hausman test	44.9	4***	35.5	6***	45.9	2***	38.7	1***
Observations	111	111	111	111	111	111	111	111
Number of countries	12	12	12	12	12	12	12	12

Table 4. Fixed effects and random effects models

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

Table 5. Cross-sectional dependence test

Variables	CD-test	p-value	average joint T
FDI	13.808	0.000	17.17
EGOV	17.482	0.000	10.00
GDPC	22.447	0.000	18.00
GDPG	20.516	0.000	18.00
OPEN	1.639	0.101	16.17
POST	2.2	0.028	18.00

Note: Under the null hypothesis of cross-section independence

Table 6. Regressions using Driscoll and Kraay standard errors

VARIABLES	FE	RE	FE	RE	FE	RE	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EGOV	2.150***	4.142***	2.150***	2.832***	2.673***	4.078**	2.673***	3.039**
	(0.361)	(1.156)	(0.361)	(0.870)	(0.525)	(1.685)	(0.525)	(1.223)
GDPC	2.519***	0.560*	2.519***	0.544	2.502***	0.785**	2.502***	1.085**
	(0.477)	(0.281)	(0.477)	(0.394)	(0.437)	(0.242)	(0.437)	(0.413)
GDPG	0.0382***	0.0285	0.0382***	0.0113	0.0525**	0.0486	0.0525**	0.0419**
	(0.0102)	(0.0163)	(0.0102)	(0.0148)	(0.0168)	(0.0307)	(0.0168)	(0.0164)
OPEN	0.000312	-0.00187	0.000312	-0.00232	-0.00156	-0.00339	-0.00156	-0.00340
	(0.00164)	(0.00147)	(0.00164)	(0.00201)	(0.00253)	(0.00211)	(0.00253)	(0.00229)
POST	0.667***	0.650*	0.667***	0.654*	0.705***	0.712**	0.705***	0.717**
	(0.179)	(0.308)	(0.179)	(0.295)	(0.161)	(0.272)	(0.161)	(0.280)

Table 6. Continued

VARIABLES	FE (1)	RE	FE (3)	RE (4)	FE (5)	RE	FE (7)	RE (8)
	(1)	(=)	(5)	(.)	(0)	(0)	(i)	(0)
Time-invariant effects	-	-	YES	YES	-	-	YES	YES
Time-specific effects	-	-	-	-	YES	YES	YES	YES
Hausman test	144.4	10***	63.7	8***	97.92	2***	41.0	4***
Observations	111	111	111	111	111	111	111	111
Number of countries	12	12	12	12	12	12	12	12

Note: Driscoll-Kraay standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 7. Robustness check

VADIADIES	FE	RE	FE	RE	FE	RE
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
EGOV	2.453***	2.619**	2.539***	2.200*	3.077***	3.169***
	(0.491)	(1.055)	(0.505)	(1.107)	(0.767)	(0.878)
GDDC	2.489***	0.910*	2.663***	0.406	2.629***	1.017***
ODIC	(0.435)	(0.421)	(0.362)	(0.382)	(0.588)	(0.303)
CDDC	0.0503**	0.0416**	0.0537***	0.0325	0.0587**	0.0481**
UDFU	(0.0173)	(0.0155)	(0.0159)	(0.0181)	(0.0210)	(0.0164)
ODEN	-0.000950	-0.00360	-0.00121	-0.00125	-0.00172	-0.00433*
OFEN	(0.00261)	(0.00210)	(0.00248)	(0.00235)	(0.00309)	(0.00229)
DOST	0.707***	0.734**	0.699***	0.486*	0.645**	0.712**
POST	(0.161)	(0.267)	(0.173)	(0.255)	(0.206)	(0.272)
LIDODC	-0.0546	-0.0578				
UFUFU	(0.0703)	(0.0723)				
INE			0.0264	-0.00875		
1101			(0.0160)	(0.0223)		
EDD					-0.0124	-0.00689
					(0.0200)	(0.0184)
Hausman test	69.45***		49.94***		141.33***	
Observations	111	111	110	110	108	108
Number of countries	12	12	12	12	12	12

Note: Both time-invariant and time-specific dummies are included; Driscoll-Kraay standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.01

inferiority of RE models. The estimate in column (7) using FE estimator and employing both timeinvariant and time-specific dummy variables as discussed in the panel analysis strategy session, is the most accurate result. Thus, a 0.01 increase in e-government development level leads to a 2.673% increase in FDI inward flows ceteris paribus. The other significant exploratory variables in the log-level form as e-government are GDP growth rate and political stability. In comparison with these two variables, the effect of the 0.01 increase in e-government is higher.

Further regressions are conducted and presented in Table 7 to check robustness with the addition of urban population growth (UPOPG) or inflation (INF), or fixed broadband subscriptions per 100 people (FBB) to the baseline model. Again, the FE models are superior according to the Hausman specification test. The coefficient of e-government development estimated by FE estimator does not change much in comparison between the baseline specification and the alternative. Therefore, the finding of the positive influence of

VADIADIES	FE	FE	FE	FE
VARIABLES	(1)	(2)	(3)	(4)
	0.864**			0.499
OSI	(0.374)			(0.474)
		-0.283		1.003
HCI		(1.715)		(1.909)
			1.476***	1.502*
111			(0.436)	(0.793)
GDPC	2.637***	2.811***	2.264***	2.334***
	(0.479)	(0.634)	(0.392)	(0.537)
CDDC	0.0485**	0.0463***	0.0549***	0.0527***
GDPG	(0.0159)	(0.00825)	(0.0165)	(0.0141)
ODEN	-0.00112	-0.000355	-0.000616	-0.000707
OPEN	(0.00256)	(0.00201)	(0.00246)	(0.00180)
DOCT	0.679***	0.642***	0.702***	0.720***
POST	(0.164)	(0.150)	(0.170)	(0.161)
LIDODC	-0.0668	-0.103	-0.0676	-0.0528
UPOPG	(0.0683)	(0.0610)	(0.0658)	(0.0630)
Observations	111	111	111	111
Number of countries	12	12	12	12

Table 8. Exploration of e-government sub-indexes

Note: Both time-invariant and time-specific dummies are included; Driscoll-Kraay standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

e-government development on FDI is consistent.

FE models have always been the better choice of estimator so far. This is consistent with the empirical literature (Leszczensky & Wolbring, 2022), as the assumption that time-invariant unit-specific error terms are not correlated with the independent variables, is very strong. The time-invariant country-specific characteristics are likely to be confounders that influence both FDI and the explanatory variables. For this reason, only FE models are applied to explore the possible different effects exerted by the components of e-government. The corresponding estimates are exhibited in Table 8.

Among the three components of e-government, the coefficients of the online service index and telecommunication infrastructure index are statistically significant when each of them enters the model as a replacement for the composite index. However, if specifying all three components, only the telecommunication infrastructure index is found significant at 10%. This finding reflects the gaps in the countries regarding infrastructure quality for telecommunication. While South Korea, Japan, and Singapore are the global leaders, poor infrastructures still bottleneck the other countries in the region. Lao PDR, Myanmar, Cambodia, Indonesia, and the Philippines only rank the 166th, 112th, 103rd, and 90th positions respectively in terms of TII (United Nations, 2020).

V. Conclusion and Implications

This study captures a causal effect of e-government development on FDI in East and Southeast Asia. This result is consistent under different estimation methods and specifications, and robust to heteroskedasticity, autocorrelation and cross-sectional dependence. Hence, it contributes significant evidence of the underlying relationship to the existing FDI literature.

Based on the findings of this study, the countries in East and Southeast Asia can consider e-government as an important and viable channel to attract FDI. As more than half of the countries in the region are still at high and middle groups of EGDI (United Nations, 2020), there are substantial rooms for these countries to develop e-government further. Especially, the global leaders, such as South Korea, Japan and Singapore, can promote cooperation, share experiences and support other countries to develop their e-governments effectively and efficiently. In addition, the countries should concentrate on telecommunication infrastructure and public online services improvement. Intuitively, this suggestion is reasonable as enhancement in human capital requires long-term development (Son, 2010).

There are still several limitations in this study. Although the study can provide empirical evidence of the positive impact of e-government on FDI inflow in East and Southeast Asia, the number of observations is quite small. In addition, because the panel is unbalanced and unequally temporal, it is only appropriate to use static models with an assumption of contemporaneous relationship. Therefore, the past values of the variables are not specified and may source the endogenous issue. Lastly, using aggregate country-level FDI inflow data can make the results less informative as the bilateral aspects between home and host countries are not included. These aforementioned limitations should be targeted in future studies if the appropriate data is available.

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