《Chapter 3》 FDI, Trade, Global Value Chains and Excahnge Rates Regimes

Inward Investment Efficiency Analysis of Mekong Countries under Economic Cooperation with China and Japan

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Abstract This paper aims to measure China's and Japan's investment efficiency in Mekong countries i.e. Cambodia, Lao PDR, Myanmar, Viet Nam, and Thailand. Based on the Knowledge-capital model of multinationals, the estimation model is built to examine the degree of Mekong's inward FDI efficiency with its efficiency determinants (market seeking, factor seeking, export-platform seeking, efficiency seeking) and institutional factors as its inefficiency determinants. Using a stochastic frontier analysis with a panel dataset of bilateral FDI flows from China and Japan to Mekong countries over the years 2009-2016, the investment efficiency scores show that there exists the inward FDI efficiency gap among Mekong countries. The stochastic regression results indicate that an increase in bilateral trade is significantly positive to the inward FDI efficiency in the Mekong region. The similarity of economic size, relative labor endowment, and trade cost are significantly negative to the inward FDI efficiency. It implies that the inward FDI efficiency in Mekong region depends on the advantage of export-platform seeking, market seeking, and efficiency seeking. Mekong's inward FDI is also significantly restricted by institutional factors. In particular, the high level of control of corruption helps to enhance the investment climate in the Mekong region. These conclusions may be beneficial for making a regional trade and industrial cooperation, and horizontal-and-vertical FDI enhancing policies in the Mekong countries.

Keywords Inward FDI efficiency, Stochastic frontier analysis, Mekong region

JEL Classification C23, F21, O53

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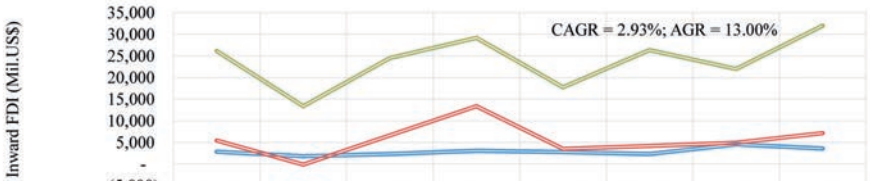
1 Introduction

Mekong region's economies (Cambodia, Lao PDR, Myanmar, Viet Nam, and Thailand: hereafter CLMVT) have been the emerging countries enhanced by foreign direct investment as a strategy of economic growth. They have grown with a large inflow of annual foreign investment growth rate for over the last decade (Figure 1). The one-third of total foreign direct investment flows to CLMVT during the period 2010-2017 was from Japan (24%) and China (12%). Lao PDR was the fourth-largest recipient of Chinese investment, whereas Thailand and Viet Nam were the top three largest recipients of Japanese investment. From ASEAN Investment Report (2015, 2016, 2017), China and Japan have been notable main players in transport and energy investment in Mekong region that have resulted in the development of regional value chain in various economic sectors.

Fig. 1 Inward FDI flows to Cambodia, Lao PDR, Myanmar, Viet Nam and Thailand, 2010-2017

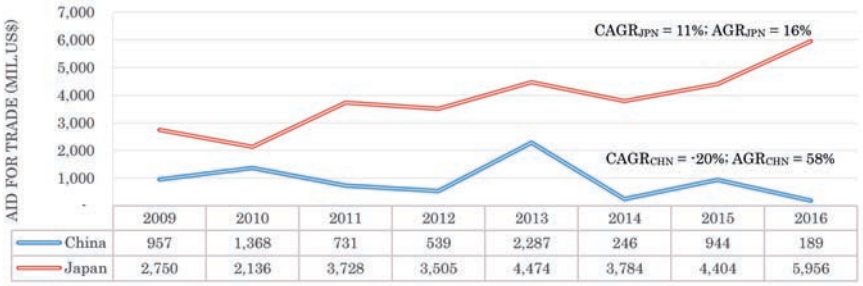


	2010	2011	2012	2013	2014	2015	2016	2017
China	2,883	1,804	2,344	3,092	2,767	2,336	4,525	3,627
Japan	5,467	(87)	6,614	13,367	3,525	4,185	4,917	7,151
Total countries	26,111	13,409	24,473	29,158	17,762	26,332	22,008	31,969

Source: ASEAN Secretariat (2018)

In fact, official development assistance in term of aid for trade (AFT) is also important to attract FDI inflows and improve regional value chain in CLMVT. Recently, China and Japan have become major players in providing aid for trade for Mekong region, especially AFT for energy-sector and transport-sector investment. Chinese and Japanese aid for trade to CLMVT grew at an average annual growth rate of 58% and 16% over the period 2009-2016, respectively (Figure 2). Importantly, Greater Mekong Subregion economic cooperation (with Japan as a leader) and Lancang-Mekong Cooperation (with China as a leader) are indeed regarded as a primary driver of the foreign investment growth in Mekong region.

Fig. 2 Aid for Trade to Cambodia, Lao PDR, Myanmar, Viet Nam and Thailand, 2009-2016



	2009	2010	2011	2012	2013	2014	2015	2016
China	957	1,368	731	539	2,287	246	944	189
Japan	2,750	2,136	3,728	3,505	4,474	3,784	4,404	5,956

Source: OECD (2018) and Institute for the Theory & Practice of International Relations (2018)

Even though an increase in FDI inflows may be responded to the level of FDI performance, but a discussion about "investment efficiency" issue is still necessary and helpful for improving and upgrading the industrial sector. Furthermore, previous empirical studies tended to examine the FDI determinants, while the FDI efficiency was not well investigated. In fact, FDI efficiency presents the level of actual FDI inflows to the maximum possible level of FDI on the frontier (Dunning, 1980; Dunning and Lundan, 2008). The recent studies were Zhou et al. (2011) Fan et al. (2016) Stack et al. (2017) and Mourao (2018). They constructed the stochastic FDI model based on the Knowledge-capital model of multinationals (Markusen, 2002) and gravity model of FDI (Brainard, 1997); and then utilized a stochastic frontier analysis (SFA) technique to measure the level of FDI efficiency. These studies suggested that determinants influencing FDI efficiency can be grouped into five categories: market size, export diversity, a difference in factor endowments (skilled and unskilled labor, capital), geography (distance, trade costs, investment costs), and economic agreements. In addition, income per capita, language, trade openness, and government efficiency were included in some studies. Most empirical results pointed out that the statistically significant effects on FDI efficiency were straightforward and intuitive. Importantly, their findings showed that market size, export diversity, and trade cost reduction were effective for enhancing FDI efficiency. From these existing studies, there are still two primary gaps. The first gap is involved in a discussion of the FDI efficiency in Mekong economies, especially FDI inflows from major investing countries such as China and Japan. The second gap is associated with the relationship between bilateral trade and FDI efficiency, and how export-and-import platform driven FDI and global value chain in trade are important to determine the level of FDI efficiency. Most studies neglect to consider the pattern and direction of trade (global value chain activities), and it is great potential for improving FDI efficiency in this paper.

This paper attempts to measure the level of China's and Japan's investment efficiency in Mekong countries (Cambodia, Lao PDR, Myanmar, Viet Nam, and Thailand) covering the period 2009-2016. It also examines the influential factors on FDI efficiency in Mekong region using a panel data stochastic frontier

analysis. The estimated results reveal that differences in economic size, bilateral trade, relative labor, trade cost, economic freedom and control of corruption are significant factors on inward FDI efficiency. The findings also indicate that FDI efficiency scores of Chinese and Japanese investors in the Mekong region are quite moderate and far from the full efficient level. However, to fill the gap between actual FDI inflows to CLMVT and FDI frontier, it is necessary to expand market capacity, stimulate bilateral trade, and promote the particular FDI location in CLMVT. Therefore, horizontal-and-vertical FDI enhancing strategies are a dominant paradigm for improving FDI efficiency in the Mekong region.

The remainder of this study is organized as follows: Section 2 describes the research methodology. Section 3 presents the empirical results of the determinants of FDI efficiency and the FDI efficiency scores. Section 4 concludes.

2 Research methodology

2.1 Model specification

Panel data stochastic frontier analysis (PSFA) (Pitt and Lee, 1981) was generally employed to measure technical efficiencies such as technical efficiency of FDI as shown in Fan et al. (2016) and Stack et al. (2017). In fact, the technical FDI efficiency is measured by the proximity of the actual FDI inflows from the FDI frontier. The FDI frontier presents the maximum FDI inflows (outputs) that are potentially acquired from a certain level of the FDI determinants (inputs), whereas the technical FDI efficiency is defined as how well a country transforms the FDI determinants into FDI inflows. If a country reaches its maximum FDI capacity, it implies that the FDI inflows to a country are fully efficient. Fan et al. (2016) developed the stochastic gravity model to evaluate the technical efficiency of Chinese's outward FDI using stochastic frontier analysis. Stack et al. (2017) built the stochastic efficiency model of FDI based on the Knowledge-capital model of multinationals to evaluate the FDI efficiency in Eastern Europe. According to these studies, a panel data stochastic frontier analysis is utilized to measure the level of FDI efficiency in this study. Based on Pitt and Lee (1981), the stochastic model with panel data is written by the following equation:

$$FDI_{ijt} = f(X_{ijt};\beta) \cdot exp(V_{ijt}) \cdot exp(-U_{ijt}) \qquad (1)$$

where i, j, and t are the indexes of the recipient country, investing country, and period, respectively. X_{ijt} are explanatory variables determining the frontier of inward FDI, such as economic size of country i and j, similarity of country i and j, income per capita of country i, export and trade between country i and j, relative factors (capital, labor) of country i to j, geographical distance between i and j, and trade cost and level of economic freedom of country i. β is a vector of unknown parameters, to be estimated. U_{ijt} and V_{ijt} are error terms. V_{ijt} is a two-sided error element representing statistical noise and measurement error

that is assumed to be the normal distribution with mean zero and constant variance, $V_{ij} \sim iidN(0, \sigma_v^2)$. U_{ijt} is a one-sided inefficiency element capturing the technical efficiency loss. It is assumed to be distributed independently of the random error that is in the form of the truncated normal distribution, $U_i \sim \text{iidN}^+(\mu, \sigma_u^2)$. Technical efficiency of FDI by country j to i is the ratio of the observed FDI and the maximum level of FDI, defined as $TE_{ijt} = \frac{FDI_{ijt}}{\widehat{FDI_{ijt}}} = \frac{exp(X_{ijt} \cdot \beta + V_{ijt} - U_{ijt})}{exp(X_{ijt} \cdot \beta + V_{ijt})} = exp(-U_{ijt})$. Higher TE_{ijt} implies higher FDI efficiency or FDI inflows closer to the FDI frontier. Following Eq. (1), the stochastic frontier specification for FDI model is specified as follows:

$$lnFDI_{ijt} = \beta_0 + \beta_1 lnSGDP_{ijt} + \beta_2 lnRGDP_{ijt} + \beta_3 lnGDPPC_{it} + \beta_4 lnTRD_{ijt} + \beta_5 lnEXP_{ijt} + \beta_6 lnRK_{ijt} + \beta_7 lnRL_{ijt} + \beta_8 lnTRDC_{it} + \beta_9 lnDIST_{ij} + \beta_{10} lnEFI_{it} + V_{ijt} - U_{ijt} \quad (2)$$

where FDI_{ijt} is FDI inflows from country j to country i at year t. $SGDPijt$ and $RGDP_{ijt}$ denote the sum of economic size and similarity in economic size of country j and country i at year t, respectively. $GDPPC_{it}$ is income per capita of country i. TRD_{ijt} and EXP_{ijt} denote flows of trade and export between country i and j, respectively. RK_{ijt} and RL_{ijt} are relative capital and labor of country i to j, respectively. $TRDC_{it}$ is country i's rade cost. $DIST_{ij}$ is a geographical distance between i and j. EFI_{it} is level of economic freedom of country i. The method of maximum likelihood is employed to estimate the parameters of the stochastic frontier with time-invariant technical inefficiency (Battese and Coelli, 1988) and stochastic frontier with time-varying technical inefficiency (Battese and Coelli, 1995). The level of technical efficiency for each country pair is measured following the conditional expectation of $\exp(-U_{ij})$. The range of values is zero to unity. An efficiency score of unity implies the coincidence between the level of actual FDI and maximum FDI on the frontier, whereas scores closer to zero express the far level of actual FDI from the frontier. With time-invariant technical efficiency, the technical efficiency is measured as $TE_{ijt} \equiv \exp(-U_{ijt})$; $U_{it}=U_i$. With time-varying technical efficiency, the technical efficiency is measured as $TE_{ijt} \equiv \exp(-U_{ijt})$; $U_{ijt}= \eta_{ijt} U_{ij}$ where U_{ij} is assumed to be a non-negative truncation of $N(u, \sigma_u^2)$, distribution and the scalar parameter η. The technical inefficiency model is defined as follows:

$$U_{ijt}= \eta_0 + \eta_1 CCI_{it} + \eta_2 GEI_{it} + e \quad (3)$$

where CCI_{it} denotes a level of control of corruption of country i at year t and GEI_{it} denotes a level of government effectiveness of country i at year t. If $\eta > 0$ is an increase in the level of efficiency towards the base level; and if $\eta = 0$ is insignificant or the level of efficiency that remains constant. Based on the model estimation, it exhibits the parameter, $\sigma^2 = \sigma_u^2 + \sigma_v^2$, and $\gamma = \sigma_u^2/(\sigma_u^2 + \sigma_v^2)$ where γ takes a value between 0 and 1. The significance of parameter γ is used to test the appropriateness of error term in the form of the stochastic frontier function: H_0: $\gamma = 0$ and H_a: $\gamma > 0$. If the null hypothesis is rejected ($\gamma = 0$), it means that the term U_{ij} should be in the stochastic frontier model.

2.2 Data

This study employs the panel data set of inward foreign direct investment from China and Japan to five recipient countries covering the period 2009-2016. The recipient countries are Cambodia, Lao PDR, Myanmar, Viet Nam, and Thailand. Data on inward FDI stocks deflated by consumer prices (2005=100), are gathered by the ASEAN Economic Community Department of the ASEAN Secretariat. Data on gross domestic products of recipient country (GDPI) and of investing countries (GDPJ) and recipient country' s GDP per capita, at constant 2005 US$, are collected by the United Nations Conference on Trade and Development. Real GDP is used to calculate bilateral economic size, $SGDP=(GDPI+GDPJ)$, and similarity in economic size, $RGDP=1-[GDPI/(GDPI+GDPJ)^2] - [GDPJ/(GDPI+GDPJ)^2]$. Data on export and trade between the recipient and investing countries at constant 2005 US$ are also gathered by the United Nations Conference on Trade and Development.

The variables of relative capital and relative labor are measured by the ratio of gross fixed capital formation and of labor force participation between the recipient and investing countries, respectively. These data were gathered by The World Bank. The variable of trade cost is expressed as the presence of trade restrictions in the recipient countries that is measured by subtracting the ratio of imports and exports to GDP ratio from 100, $TRDC=100 - [(TEXP+TIMP)/GDPI]$ where TEXP and TIMP are total exports and imports of the recipient countries at constant 2005 US$. These data are collected by the United Nations Conference on Trade and Development. Data on geographical distance between capital cities of the recipient and investing countries is measured in kilometers.

Data on the level of economic freedom of recipient counties are evaluated by the Heritage Foundation. The higher scores show the economic freedom in the pursuit of greater economic development (Miller et al., 2008). Data on the recipient country's control of corruption and government effectiveness as dimensions of worldwide governance indicator are evaluated by The World Bank Group. They are ranged from approximately -2.5 (weak) to 2.5 (strong) governance performances. Table 1 shows the descriptive statistics of the model variables.

Table 1 Descriptive statistics

Variable	Description	Unit	Mean	Standard deviation	Minimum	Maximum	No. of observations
FDI	Foreign direct investment of country i from j	Mil.US$	2,161.79	4,489.46	0.10	23,217.21	80
SGDP	Sum of GDP between country i and j	Mil.US$	6,403,024	1,128,732	4,577,048	8,759,540	80
RGDP	Similarity in GDP of country i and j	Ratio	0.02	0.03	0.002	0.11	80
GDPPC	GDP per capita of country i	US$	1,406.93	1,512.85	435.25	4,621.68	80
TRD	Bilateral trade of country i and j	Mil.US$	12,807.72	17,862.93	78.53	54,517.29	80
EXP	Bilateral export of country i and j	Mil.US$	5,880.21	9,188.53	17.84	35,383.28	80
RK	Relative capital of country i to j	Ratio	0.02	0.03	0.001	0.11	80
RL	Relative labor of country i to j	Ratio	0.19	0.18	0.01	0.50	80
TRDC	Trade cost of country i	Index	98.97	0.52	97.86	99.71	80
DIST	Distance between country i and j	Kilometers	3,424.90	936.36	1,925.00	4,607.00	80
EFI	Economic freedom index of country i	Scores	53.63	7.55	36.70	66.20	80
CCI	Control of corruption of country i	Scores	-0.85	0.39	-1.67	-0.31	80
GEI	Government effectiveness of country i	Scores	-0.56	0.60	-1.62	0.35	80

Source: Authors' calculation

3 Empirical results

3.1 The model estimates

Table 2 exhibits the maximum likelihood estimates for the stochastic frontier model with a time-varying technical efficiency of Chinese and Japanese FDI into CLMVT countries covering the 2009-2016 period. Column (1) shows the empirical results over the full sample. To reach an insight into the different economies, columns (2) and (3) separately present the results for Chinese and Japanese FDI into the Mekong region. The parameter γ is significant which implies the appropriateness of a variation in the composed error term to the inefficiency component; whereas the insignificance of parameter γ indicates that the variation in the composed error is attributed to the random error term. The goodness-of-fit of the chosen model is confirmed by the statistical significance of the log-likelihood value.

Table 2 Estimation results of the stochastic frontier model with time-varying technical inefficiency

Efficiency determinants	CHINA and JAPAN		CHINA		JAPAN	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
SGDP			3.86*	8.39	19.43*	4.15
RGDP	-0.89**	-2.22				
GDPPC	-0.17	-0.43				
TRD	1.93*	9.45				
EXP			-0.0005	-0.01	-1.07**	-2.14
RK	0.32	0.74			2.74*	3.70
RL	-1.72*	-4.23	0.49*	3.58		
DIST	8.15*	8.80				
TRDC	-88.44*	-2.46	71.28*	2.37	-124.62*	-4.61
EFI	-0.14*	-4.32	0.001	0.14	0.08**	2.01
constant	320.92**	1.96	-379.66*	-2.68	297.13***	1.81
Inefficiency determinants:						
CCI	-0.79***	-1.85	1.91***	1.88	36.66***	1.76
GEI					-34.02**	-1.99
constant	3.52***	1.68	1.18	1.20	8.22	1.12
Variance parameters:						
Sigma u	10.71	0.93	1.27	0.77	6.33	0.33
Sigma v	0.58*	5.45	0.21*	2.54	0.34*	3.32
Lambda	18.34	1.59	5.94*	3.62	18.41	0.95
Gamma	0.99		0.97		0.99	
Log-likelihood	-108.27		-23.31		-37.45	
Chi-square	301.91*		83.10*		753.73*	
LR test	3.89**		3.63**		19.38*	
VIF	20.88		2.26		20.65	
Obs.	80		40		40	

Note: 1) *, **, *** significant at 1, 5, 10 percent levels.

2) Lambda = Sigma u/Sigma v. 3) Gamma = Sigma u squared / Sigma squared.

Source: Authors' calculation

The estimates of China's and Japan's FDI efficiency model can be categorized into four groups.

First, it concentrates on the relationship between economic size and FDI efficiency including the role of market-seeking FDI (either final goods market or intermediate goods market). In a theoretical context, the difference in market size favors vertical FDI (Multinationals fragment production process internationally), whereas similarity in economic size favors horizontal FDI (Multinationals duplicate the same activities abroad) (Baltagi et al., 2007). The finding reveals that the coefficient of RGDP is negative and statistically significant at the 5% level. The difference in economic size between investing and recipient countries is one of the major drivers enhancing vertical FDI close to the efficient level.

Second, it focuses on the linkage of trade and FDI efficiency. The estimated coefficient of bilateral trade between countries is positive, statistically significant at 1% level. It indicates that China's and Japan's trade in Mekong region encourage Chinese and Japanese FDI in CLMVT for taking advantages of market access, proximity to intermediate goods, and export-and-import platform. In fact, it tends to support vertical FDI. Moreover, it may reflect that the value chain in trade (both backward and forward value

chain) between the recipient and investing countries contributes to the CLMVT's inward FDI efficiency. Table 3 shows the share of intra-industry trade IIT in manufacturing goods between CLMVT, China and Japan during the period 2009-2016, providing an insight into the trading pattern in the same industries and the CLMVT's products in China and Japan market. Higher IIT implies rising and deepening trade flows between CLMVT and Chinese and Japanese partner country. Among CLMVT economies, Vietnam obtained the highest levels of intra-industry trade in resource-based, low-technology and medium-technology manufacture with China and Japan, whereas Thailand has the highest level of intra-industry trade index in high-technology manufactures with them. Hence, it is possible that the high level of the value chain in trade between countries attracts higher FDI inflows at the industry level.

Third, it concentrates on the relationship between factor endowment and FDI efficiency. The estimated coefficient of relative labor is negative and statistically significant at 1% level. This negative relation indicates that difference in labor endowment is important to attract "resource-seeking and efficiency-seeking" investment from China and Japan, enhancing the efficiency of FDI inflows to Mekong region. This empirical result is consistent with the theory of FDI "Knowledge-capital model" and the existing studies.

Table 3 Intra-industry trade index between China, Japan, and CLMVT countries, 2009-2016

Manufacture	Cambodia		Lao PDR		Myanmar		Thailand		Viet Nam	
	China	Japan	China	Japan	China	Japan	China	Japan	China	Japan
Resource-based	0.486	0.081	0.117	0.249	0.602	0.373	0.623	0.659	0.751	0.961
Low-technology	0.145	0.146	0.055	0.265	0.112	0.145	0.225	0.580	0.412	0.783
Medium-technology	0.021	0.176	0.077	0.080	0.092	0.010	0.016	0.0005	0.160	0.744
High-technology	0.238	0.127	0.008	0.370	0.028	0.281	0.649	0.678	0.430	0.600

Note: Intra-industry index by is measured by $\left[1-\left(\frac{|X_{ij}-M_{ij}|}{(X_{ij}+M_{ij})}\right)\right]$ where Xij and Mij are the values of country j's export and imports respectively for commodity i (Grubel and Lloyd, 1971).
Source: Authors' calculation and UNCTAD (2018a)

Finally, it focuses on the relationship between the efficiency factors e.g. geography distance and trade cost and FDI efficiency. The estimated coefficient of geographical distance is positive and statistically significant at 1%. It indicates that the advantage of geographic proximity between investing and recipient countries is not a key driver for improving FDI efficiency in the Mekong region. This empirical result appears to contradict the results obtained from Fan et al. (2016) and Stack et al. (2017). However, the coefficient of trade cost is negative, statistically significant at 1% level. The trade cost reduction or the absence of trade barriers helps to improve China's and Japan's FDI flows to Mekong region close to the efficient level, especially vertical FDI inflows.

Additionally, the coefficient of economic freedom is negative, statistically significant at 1% level. Economic freedom index represents a degree to which the policies and institutions of countries are supportive of economic freedom (The Heritage Foundation, 2018). The finding indicates that free market

in Mekong region discourages an investment from China and Japan, lessening the efficiency of FDI inflows to CLMVT. This empirical result contradicts to earlier hypothesis made in Fan et al. (2016).

According to the FDI inefficiency model, the coefficient of the institutional factors i.e. controls of corruption is statistically significant at 1% level. Control of corruption is one of the institutional risk factors that has been generally incorporated into the model for FDI analysis. It was also hypothesized that a high level of control of corruption in a recipient country will result in a higher FDI inflow. However, the finding presents that the control of corruption in CLMVT lowers the FDI inefficiency in the Mekong region. The result is consistent with Yao et al. (2018).

To check the robustness of the CLMVT model, equation (2) is also estimated separately as shown in column (2) for Chinese investment and column (3) for Japanese investment. The empirical results in Column (2) exhibit that economic size, relative labor endowment, and trade cost are positive significant factors for China's FDI inflows to the Mekong region. It is obvious that China's FDI in CLMVT is more likely to be a horizontal type for market-seeking. Meanwhile, the empirical results in Column (3) present that economic size, relative capital, and economic freedom are positive significant factors for Japan's FDI inflows to Mekong region, whereas bilateral export and trade cost is negative significant factors. It ensures that Japan's FDI in CLMVT is more likely to be both horizontal and vertical types for market-seeking and efficiency-seeking. In addition, to improve the efficiencies of China's and Japan's FDI in the Mekong region, horizontal and vertical FDI-enhancing policies are simultaneously implemented.

Interestingly, the coefficient of CCI is positive statistically significant at 10% level in both China's FDI efficiency model, column (2) and Japan's FDI efficiency model, column (3). It implies that the high level of control of corruption in the Mekong region increases the FDI inefficiency in CLMVT economies. These results are different from the whole FDI efficiency model, column (1).

Table 4 Estimation results of the stochastic frontier model with time-invariant technical inefficiency

Efficiency factors	CHINA+JAPAN		CHINA		JAPAN	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
SGDP			3.26*	8.13	26.15*	4.47
RGDP	-1.57*	-3.22				
GDPPC	-1.36*	-2.47				
TRD	1.62*	7.19				
EXP			0.10	1.16	0.10	0.19
RK	2.35*	4.16			1.46***	1.83
RL	-2.88*	-5.27	0.36***	1.88		
DIST	8.09*	5.32				
TRDC	-83.88	-1.57	-59.59***	-1.62	-16.85	-0.23
EFI	-0.01	-0.59	-0.05*	-2.49	0.15*	3.68
constant	309.63	1.27	232.10	1.34	-327.03	-0.83
Variance parameters:						
Gamma	0.95		0.99		0.96	
Log-likelihood	-103.71		-24.17		-49.41	
Chi-square	235.52*		176.98*		159.90*	
VIF	20.88		2.26		20.65	
Obs.	80		40		40	

Note: 1) *, **, *** significant at 1, 5, 10 percent levels.

2) Lambda = Sigma u/Sigma v. 3) Gamma = Sigma u squared / Sigma squared.

Source: Authors' calculation

In addition, Table 4 exhibits the maximum likelihood estimates for the stochastic frontier model with the time-invariant technical inefficiency of Chinese and Japanese FDI flows to Mekong countries covering the 2009-2016 period. Column (1) shows the empirical results for both Chinese and Japanese investment, whereas columns (2) and (3) present the results for China's and Japan's investment, respectively. The goodness-of-fit of the models is confirmed by the statistical significance of the log-likelihood value. Regarding the China's and Japan's FDI efficiency model, column (1), the empirical results show that all of the estimated coefficients are quite similar to the estimates of a stochastic frontier model with time-varying technical efficiency. That is, a difference in economic size, bilateral trade, capital abundance, a difference in relative labor, and geographical distance are positive significant factors for Chinese and Japanese FDI inflows to Mekong region. Moreover, the estimated coefficients of China's FDI efficiency model, column (2) and Japan's FDI efficiency model, column (3) are also similar to the estimates of a stochastic frontier model with time-varying technical inefficiency.

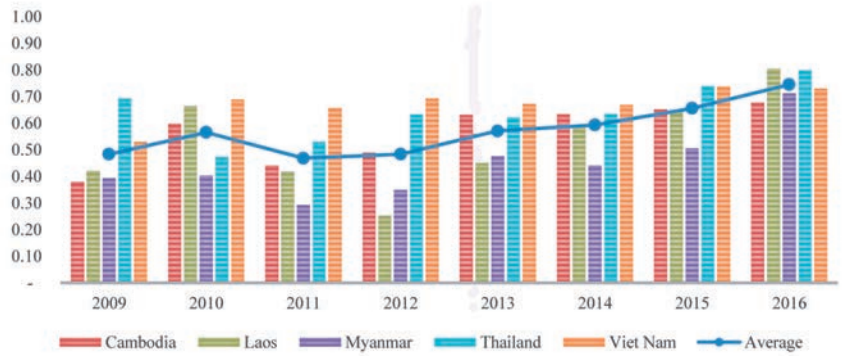
These findings give strong support to the importance of economic size, bilateral trade, factor endowment, geographical distance, and trade cost on the FDI efficiency. Horizontal and vertical FDI-enhancing policies are necessary to improve the efficiencies of China's and Japan's FDI in the Mekong region.

3.2 Investment efficiency scores

Figure 3 shows the overall efficiency of Chinese and Japanese investment into CLMVT during 2009-2016 and Table 5 summarizes the efficiency scores from China's and Japan's investment. The FDI efficiency can range from 0 (weakest) to 1 (strongest), where the strongest score means the maximum possible efficiency for FDI inflows. The findings indicate that the efficiencies from Chinese and Japanese investment in the Mekong region have somewhat changed from 2009 to 2016. The average efficiencies from China's investment arise from 0.58 over the period 2009-2012 to 0.63 over the period 2013-2016, as well as, the average efficiencies from Japan's investment arise from 0.41 over the period 2013-2016 to 0.64 over the period 2013-2016.

The Chinese investment efficiencies are rather higher than Japanese investment, but there is a large potential for enhancing inward FDI. In 2016, the average FDI efficiency of Mekong region attained 68-80% of its maximum FDI capacity. The gap between actual FDI inflows and the maximum possibility frontier remains. It means that the Mekong region has a potential for enhancing inward FDI.

Fig. 3 The overall efficiency of Chinese and Japanese FDI into CLMVT during 2009-2016



Source: Authors' calculation

Based on the average FDI efficiency covering the period 2009-2016, the levels of FDI efficiency in Mekong region can be categorized into three groups: somewhat high-average scores (average scores ≤ 0.7), moderate-average scores ($0.5 <$ average scores < 0.7), and low-average scores (average scores ≤ 0.5).

Among CLMVT economies, Thailand is ranked in the high level of Japan's FDI efficiency and the moderate level of China's FDI efficiency. Cambodia, Lao PDR and Viet Nam are categorized in the moderate level of Chinese and Japanese FDI efficiencies. Myanmar is ranked in the moderate level of China's FDI efficiency and the low level of Japan's FDI efficiency.

However, Chinese and Japanese FDI inflows to Mekong region remain far from taking full inward FDI efficiency. Hence, CLMVT economies should improve the level of FDI efficiency (in order to eventually achieve the maximum FDI efficiency).

Table 5 Efficiency scores for China's and Japan's FDI to CLMVT, 2009-2016

	China			Japan		
	2009-2012	2013-2016	Average	2009-2012	2013-2016	Average
Cambodia	0.5105	0.6525	0.5815	0.4436	0.6441	0.5439
Lao PDR	0.4823	0.5941	0.5382	0.3962	0.6491	0.5227
Myanmar	0.6957	0.6405	0.6681	0.0232	0.4268	0.2250
Thailand	0.5481	0.5850	0.5666	0.6146	0.8133	0.7139
Viet Nam	0.6633	0.7062	0.6848	0.6203	0.6975	0.6589
CLMVT	0.5800	0.6357	0.6078	0.4196	0.6462	0.5329

Source: Authors' calculation

4 Conclusion and policy implication

This study examines the determinants of inward FDI efficiency and the levels of China's and Japan's investment efficiency in Cambodia, Lao PDR, Myanmar, Viet Nam, and Thailand. Using the panel stochastic frontier analysis, the findings show that bilateral trade and geographical distance are significantly positive to inward FDI efficiency in Mekong region, whereas similarity in economic size, relative labor, trade cost, and economic freedom are negative significant factors on the FDI efficiency. Importantly, the higher level of control of corruption in CLMVT helps to reduce the FDI inefficiency in the Mekong region.

It also found that Chinese and Japanese investment in Mekong countries can generate the FDI efficiencies in Mekong countries at a moderate level. The advantages of market seeking, efficiency seeking, and export-and-import platform seeking are key success factors of an improvement in FDI efficiency in the Mekong region. Therefore, horizontal and vertical FDI-enhancing policies in CLMVT economies are necessary. Several implications for practice and policy can be drawn from these empirical results.

First, promoting the intra-regional and extra-regional connectivity is essential to boost economic growth in the region. Especially, trade and investment facilitation are an important catalyst for eliminating cross-border trade and investment obstacles and enabling favorable trade and investment environment.

Second, it is important and necessary to enhance regional value chain participation for approaching the FDI frontier with relatively high-efficiency scores. The adoption and adaptation of modern trade channels could help firms to move their FDI frontier up and become more attractive for investment.

Third, improving labor skills and labor standard is critical for foreign firms to obtain economies of scale, higher consistent quality, and higher efficient production. It also helps to enhance the investment climate and attract foreign investors.

Fourth, the regional connectivity of hard and soft infrastructure is a priority for strengthening inclusive investment and equitable development in the Mekong region.

Lastly, the coherence and synergy among national and international investment policies are important to build foreign investor confidence in the Mekong region (UNCTAD, 2018b). Investor confidence has an

important role in foreign investor decision making.

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