

INFRASTRUCTURE AS A LIFELINE FOR FOREIGN DIRECT INVESTMENT IN THAILAND: ROLE OF QUALITY OF RAILROAD, AIR TRANSPORT AND ROAD INFRASTRUCTURE

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ABSTRACT:

In recent years, the Thailand economy has become more open to foreign trade as well as foreign direct investment (FDI). Policy reforms claim that countries with good transport infrastructure attract more FDI. Thus the following study was designed with the aim to analyze the impact of quality of railroad, air transport and road infrastructure on foreign direct investment. For this purpose time series data was collected from Thailand on these variables and subjected to the vector autoregressive representation (VAR) model for analysis. The data was made stationary and integrated prior to modelling. The outputs revealed that the quality of three independent variables related to transport infrastructure were positively correlated to FDI in Thailand. This study may provide assistance to the government and policy makers in devising policies that favor the maintenance of quality of railroads, air transport and roads so that these aspects may increase the amount of FDI in the country in the long run.

Keywords:

Foreign direct investment, Infrastructure, VAR model, Railroads, Air transport, Road infrastructure, Thailand

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INTRODUCTION

In the present era, developing economies are the most favorable destinations for the inflows of foreign direct investment (investment in local resources). Thailand holds the most prominent geographic presence among the emerging economies. Being the 50th largest country, occupying 513,115sq km, it ranked 20th among the most populated countries of the world. Aside from location strength, Thailand has the base of a huge market with high purchasing power and is considered an upper-middle-income economy (Hussain, Mosa, & Omran, 2017). The economy of Thailand is considered as a “newly industrialized economy”. The industrialization is the result of the paradigm shifts in its economic strategies and preferences from being centered on the agricultural boost to export, FDI-driven and industrialized economy (Yusoff & Nuh, 2015). The Thai economy is the 20th largest in the world in terms of GDP. The leading sectors that contributed to its economic growth are tourism, manufacturing, and agriculture (Srisangnam,

2019). As mentioned by Liu, Li, and Parkpian (2018), the flourishing Thai service sector is tourism, which makes the country a popular tourist destination and boosts tourism growth [see: fig 1].

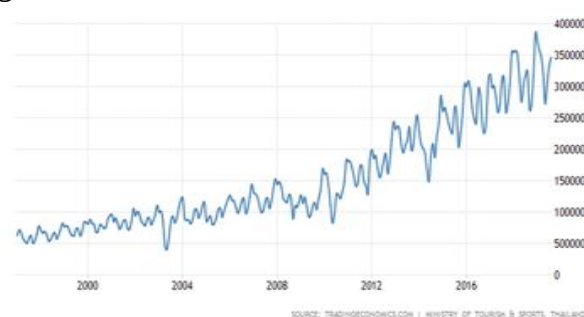


Fig 1: Tourist Arrivals in Thailand

In Thailand, there are diverse sources of inward FDI comprises of United States, Japan, Europe, Taiwan, Hong Kong, South Korea, and other countries (Hussain, Mosa, & Omran, 2018). The major source of inward FDI was Japan since the 1970s, but its contribution started to decline in the late 1990s as shown in figure 2. Later, during 2002-2008, the FDI inflows increased due to the depreciation of Thai currency which led to the

increased purchasing power of foreign investors and boost acquisitions. Another underlying factor was the increased labor costs in Japan, Hong Kong, Taiwan, and other developing countries resulted in relocations of production bases. Contrary to the preceding trend, high variability in the FDI trends were observed during 2011-2012, due to insufficiency of human resources accompanied by the inadequacy and lack of focus on public infrastructure.

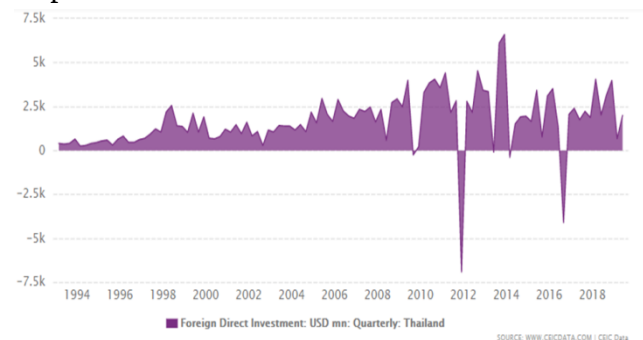


Fig 2: FDI Inflows into Thailand during 1994-2018

Recognizing the significance of FDI, many countries are inclined towards the attraction of FDI inflows both in terms of Greenfield investment and mergers & acquisitions. For this purpose, a plethora of researches has been conducted to explore the factors that determine FDI inflows around the globe. The determinants of FDI were examined in Thailand by Xaypanya, Rangakulnuwat, and Paweenawat (2015), they found the positive statistical associations between size of the market, openness for trade, infrastructure facility, and FDI (Hussain, Musa, & Omran, 2019). While the inverse impact of inflation on inward FDI was observed. Similarly, the macroeconomic elements that affect inflows of foreign direct investment were highlighted during the period of 2000-2016 in ASEAN countries (Deng, 2013). The results indicated the negative effect of real exchange rate on FDI (Chakpitak, Srichaikul, Yamaka, & Sriboonchitta, 2019). In addition, Anuchitworawong and Thampanishvong (2015) analyzed the role of natural disasters in determining FDI inflows and the findings revealed that the occurrence of

natural disasters with high severity, lowers the inflow of FDI in Thailand.

However, the earlier studies have examined several factors that affect FDI inflows including quality of infrastructure also but the scarcity of studies was evidenced in determining the role of infrastructure quality specifically in terms of a railroad, air transport and road infrastructure towards attracting the FDI inflows into Thailand (Hussain, Musa, & Omran, 2018). These infrastructure specifications and their importance in determining the FDI levels was not yet highlighted. Thus, the present study contributed to the fulfillment of research gap, and proposed the following research objectives:

1. To analyze the impact of the quality of railroad infrastructure on inward FDI in Thailand.
2. To determine the impact of the quality of air transport infrastructure on inward FDI in Thailand.
3. To check the role of road transport infrastructure on inward FDI in Thailand.

The inflow of FDI has significant impact on the economy of the world. It fosters the technological advancement in the country, as foreign corporations bring advanced technologies with their operations (Hussain et al., 2012). It creates access opportunities for business expansion to foreign markets for the local businesses along with the development of human capital through versatile market knowledge and skills. Also, the economy also flourishes smoothly with healthy competition in business markets which provides consumers with a variety of alternatives and pricing options.

LITERATURE REVIEW

1.1 Theoretical Background

FDI inflows are recognized as the key driver of economic growth of the country (Flora & Agrawal, 2017; Dechprom & Jermstittiparsert, 2018). The investments made by means of FDI in terms of acquisitions, licensing, subsidiaries and placement of production facilities in a host

country facilitated the economic growth of the country in multiple ways. Among the other contributors to the Thai economic transformation, the major factors are infrastructure and foreign direct investment inflows. Because it not only accounts for the stimulation of economic growth but also boost the investment capital along with intellectual and technological capital (Azam, Nawaz, & Riaz, 2019; Chen, 2018). For determining the impact of quality of infrastructure on inward FDI in Thailand, this study incorporates Dunning's Eclectic Theory (also known as OLI framework). It is the extension of the internalization theory proposed by him in 1976. The theory proposed that there are three major factors that contributed to the attraction of FDI. These factors are: "ownership, location and internalization" (Dunning, 1993). According to Dunning (2015) a country can attract FDI if it possessed the following advantages: Ownership advantages that cover the degree of ownership rights in the host country including trademarks, patents, and copyrights. Another is Location advantages which include benefits associated with production location and infrastructure of the host country including its geographic location, environment, production sites, natural or created resources, its road infrastructure, airport systems and other mediums used for trade and incurs transaction costs. Lastly, the Internalization advantages, includes the medium through which the firm will be operated in the host country, such as joint venture, licensing, exports or subsidiary, it is concerned with commercial benefits more than the home country.

Several studies have incorporated the theory for an in-depth understanding of international trade decisions and investments (Cantwell, 2015a; Cantwell, 2015b; Khan & Nawaz, 2010). The findings concluded that infrastructure of transport in terms of railroad, air transport and railways are the significant predictors of progress of a country and its trade and investment policies. From the empirical evidence, the development of transport infrastructure is considered a lifeline for

the foreign direct investment because logistics design determines the feasibility of the host country for the business operations. In Thailand, due to insufficiency of human resources accompanied by the inadequacy and lack of focus on public infrastructure including railroad systems, air transport, and road infrastructure development the FDI trends are unsatisfactory. Therefore, in order to attract high FDI inflows and attracts the major sources of FDI i.e., Japan, Hong Kong, United States, china etc. and to gain the maximum perks of FDI, it is essential for Thailand to direct its attention towards the factors that account for the inward FDI inflows in the country. Another is Location advantages which include benefits associated with production location and infrastructure of the host country including its geographic location, environment, production sites, natural or created resources, its road infrastructure, airport systems and other mediums used for trade and incurs transaction costs. Lastly, the Internalization advantages, includes the medium through which the firm will be operated in the host country, such as joint venture, licensing, exports or subsidiary, it is concerned with commercial benefits more than the home country.

Thus, the present study proposed the following conceptual model presented in figure 3 by taking into consideration the location factor of the OLI framework as the determining factor of FDI inflows. It is assumed that Quality of Railroad Infrastructure, Quality of Air Transport Infrastructure, and Quality of Road Infrastructure (independent variables) are the determinants of inward FDI (dependent variable) in Thailand.

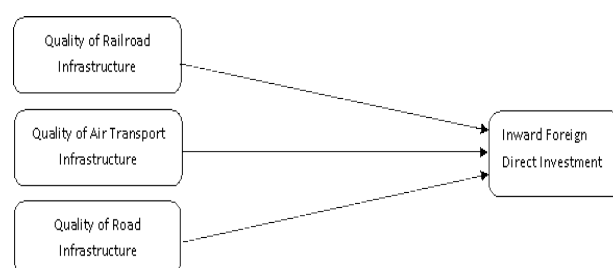


Fig 3: Conceptual Model, Source: Author's Construction

1.2 Quality of Railroad Infrastructure and Inward Foreign Direct Investment

Infrastructure plays a prominent role in determining the operating and transaction costs of a business which are the basis of investment decisions by foreign investors as postulated in the OLI framework (Cantwell, 2015b). A well-developed infrastructure results in the reduction of transaction costs and provides operational benefits. Many studies have emphasized the importance of railways and the quality of railroad infrastructure for economic growth and ultimately for attracting the FDI in the country (Kaur, Khatua, & Yadav, 2016). While studying the major determinants of FDI inflows, the findings of Shi, Guo, and Sun (2017) highlighted that the construction of railways and its effective operations without any scheduling disruptions creates a favorable environment for bulk transportations across and within cities and attract investors, being the affordable medium of transportation integrated with high-density rail corridors, capacity enhancement along with the up gradation of passenger handling system. All these systems fosters the improved infrastructure and attracts higher levels of FDI.

Similarly, a vital role is played by transportation infrastructure in the reduction of pollution levels and to reduce environmental degradation (Escribano, Guasch, & Pena, 2010). As high-speed railways, rail links and electronic trains decreases the pollution intensity in various parts of the world including UAE, China, etc. These environment-friendly railway systems contributed towards the improved environmental performance and help in preserving the natural environment (Sun, Zeng, Lin, Meng, & Yu, 2019). Also, the FDI inflow trends and growth rate were examined during the period of 1971-2016 in India. It is revealed from the empirical results that railroad systems and overall physical infrastructure are the crucial determinants of FDI (Gupta, 2018). As the efficient railroad infrastructure led to reduces freight costs resulting in high trade volumes because better

transportation facilities attract the corporations to transfer their operation in order to attain cost benefits and high profitability (Kumar & Bhat, 2019). As high-speed railways, rail links and electronic trains decreases the pollution intensity in various parts of the world including UAE, China, etc. These environment-friendly railway systems contributed towards the improved environmental performance and help in preserving the natural environment. Moreover, a causal statistical association between rail road's infrastructure and economic growth was evidenced. The developed railway transportation system reduces the degree of distance costs and is favorable for huge shipments (Saidi & Hammami, 2017). Therefore, based on the reviewed literature and the recognition of importance of railroad infrastructure quality in the determination of FDI, the current study hypothesized that:

H1: Quality of railroad infrastructure has a significant impact on Inward FDI.

1.3 Quality of Air Transport Infrastructure and Inward Foreign Direct Investment

A favorable air transport infrastructure is highly important for the host country in order to be the most suitable destination for foreign direct investment indicated by J. Dunning (1993) as efficient supply chain design is essential for a firm for the operation of a business (Hakim & Merkert, 2017). The quality of air transport infrastructure includes the development of airports, control centers for air traffic, passenger handling services, and air navigation services (Khadaroo & Seetanah, 2007). It plays a significant role, being the medium through which foreign investors, foreign delegations can travel and move easily from one city or country to another (Halaszovich & Kinra, 2018). A noticeable increase in FDI levels in Turkey was observed through the development of air traffic system and it was emphasized that the cities or provinces with larger air traffic systems and international access tend to attract huge levels of FDI inflows (Ozcan, 2018). Moreover, with the improved and effective aviation infrastructure, foreign investors analyzed the business conditions

of the host country in a more proficient manner, they can visit in order to identify the potential avenues for their investments in many firms, such as licensing, opening a subsidiary or the placement of production facilities (Wessel, 2019). Also, the development of air transport infrastructure determines the trade levels and increases the probability of high FDI as, efficient flight schedules and routes boost export and import for corporations (Latorre, Yonezawa, & Zhou, 2018). FDI is considered an essential mean of economic development, and the availability of international transportation mediums with alternative airlines and affordable fares, the investors are attracted to the destination (Kyriacou, Muinelo-Gallo, & Roca-Sagalés, 2019). The major finding of the research indicated the impact of global airline management system on foreign direct investment trends in Italy. It was argued that the development of a new route with reduced transportation costs increases the chances of regional integration among connected countries. A total of 33.8% increase in FDI was evidenced by the new route opening (Donaubauer, Meyer, & Nunnenkamp, 2016). In addition, supportive air transport infrastructure in terms of favorable travel conditions and the availability of airports at multiple destinations attracts foreign investors as it saves them from long flights and they are able to cover the distance with shorter routes (Yingxi & Hung, 2018). It is observed that the international trade flows and cross border investments are influenced by the logistics transport infrastructure (Mehar, 2017) and the off-shoring decisions are made on the basis of logistics design in the host countries as it resulted in the reduction of handling, time and transportation costs in the shipment process (Dorożyński & Kuna-Marszałek, 2016). Supportive air transport infrastructure in terms of favorable travel conditions and the availability of airports at multiple destinations attracts foreign investors as it saves them from long flights and they are able to cover the distance with shorter routes. Thus, in view of the discussed findings

emphasized on the role of air transport infrastructure quality in the determining FDI inflows, the current study hypothesized that:

H2: Quality of air transport infrastructure has a significant impact on Inward FDI.

1.4 Quality of road Infrastructure and Inward Foreign Direct Investment

The quality of road infrastructure is considered an essential factor in the attraction of FDI in a country (Cantwell, 2015a). As purposely built routes and road systems are essential in day to day transportation and travel (Jacobs, 2017). Moreover, a study by Wekesa, Wawire, and Kosimbei (2016) investigated the impact of road infrastructure development on FDI in Kenya. The results indicated that the quality of road infrastructure plays a prominent role in FDI alternatives as it lowers the cost of running a business with a conducive environment of transportation (Mac Kinnon, Brouwer, & Samuelsen, 2018). In the same vein, it was postulated that the density of road and the quality of road infrastructure are the key drivers of economic growth and FDI as it acts as a medium of trade and determines the transit quality and international trade levels (Maparu & Mazumder, 2017). Similarly, among other advantages, the boost of export specialization due to highways and connecting roads appears to be the most significant factor in the attraction of FDI as it influences the firm's exports and trade flows (Nasreen, Saidi, & Ozturk, 2018). Likewise, the predictors of foreign direct investment and economic growth was studied in Malaysia and the findings confirmed that there is a significant and positive impact of road infrastructure with high density on the growth trends and FDI and it was suggested that the countries needs to focus on infrastructure development for boosting the investment trends and economic welfare (Azam & Bakar, 2017). It was found by several scholars that the key sources of economic prosperity and growth are the improvement in the quality of transport infrastructure along with communication infrastructure as they hold the huge potential for FDI promotion and economic productivity in the

long run (Saidi, 2016). Moreover for FDI attraction, the road infrastructure is considered important because it reduces the cost levels of heavy equipment transportation in shifting or construction of a production facility in the host country (Sun et al., 2019). In addition, the efficiency levels of corporations also increased with the well-defined routes and roads in the shipment of its products and it improved the raw material collection cycle also which led towards increased productivity (Sun et al., 2019). Thus, in view of the discussed findings emphasized on the role of road transport infrastructure quality in determining FDI inflows, the current study hypothesized that:

H3: Quality of road infrastructure has a significant impact on Inward FDI.

METHODOLOGY

1.5 Data

Data collection is a basic and most important part of any research process as the results of any research depend upon the accuracy and correctness of data. In this time series analysis, the time series data consisting of 29 years has been collected from Thailand, the country for which the study has been conducted. FDI, Quality of railroad, air transports and road infrastructure are the basic concepts and the variables around which this study revolves and the data is also concerned about these variables. The quality data has been collected from authentic data bases such as World Bank database and Global Economy database.

1.5.1 Model Specification

Regression equation is an integral part of research process and can be generated after the identification of various measurement units of several variables that are under consideration in the particular study. Let us discuss them one by one. The first variable in the list is the only dependent variable, FDI which has been measured by the units of billion US dollars. The next variable in this regard is an independent variable i.e. quality of railroad and has been measured by the use of an index that ranges from 0-100. In the same way, the other independent variable, quality of air transport can also be measured by using the same index that ranges from 0-100. The last independent variable, quality of road infrastructure has the same index ranging from 0-100. Moreover, the first control variable, ease of doing business also has an index based on ease of doing business while the last control variable, trade openness will be measured by using the units of percentage of GDP. By using different representations, a regression equation has been constructed as given below:

$$FDI_t = \alpha + \beta_1 RAIL_t + \beta_2 AIR_t + \beta_3 ROAD_t + \beta_4 EDB_t + \beta_5 OPEN_t + \varepsilon_t$$

In the above equation, FDI shows foreign direct investment, RAIL shows the quality of railroads, AIR shows the quality of air transport system, ROAD represents the quality of roads, EDB denotes the ease of doing business concept while OPEN shows the trade openness in a country. Other than these, ε_t represents the presence of an error.

Authors	Country	Period	Variables	Methodology	Results
Erdal and Tatoglu, (2002)	Turkey	1980-1998	Infrastructure, trade openness and FDI	Cointegration analysis	Positive relation found between FDI and independent variables
Kirkpatrick et al., (2004)	67 low- and middle-income countries	1990-2002	Infrastructure and FDI	Principal component analysis of Kaufmann's indices	foreign investment responds positively to infrastructure
Sahoo, (2006).	south Asian countries (India, Pakistan, Bangladesh, Sri Lanka and Nepal)	1975-2003.	Infrastructure and FDI	Panel cointegration analysis	all five south Asian countries lack adequate infrastructure facilities and open trade policies to attract FDI
Chen, (1996)	China	1987- 1991	Foreign direct investment (FDI) and transportation infrastructure	Conditional logit model	Interregional railroad connections are found to be positively related to of FDI
Yusoff and Nuh, (2015).	Thailand	1970-2008	FDI and Trade openness	VECM model	FDI and trade openness are interrelated and positively influence economic growth

Table 1: Empirical evidence from past studies

1.6 Estimation Procedure

1.6.1 The Order of Integration and Testing for Cointegration

The first and foremost step in time series analysis after data collection is to assess the order of integration of dependent, independent and control variables being analyzed in relation to each other in this study. Apart from the integration order analysis, in order to validate the stationary or non-stationary status of variables selected for analysis, penal unit root test is performed on the acquired data. A stationary data is one whose statistical properties do not change over time. There are various tests for stationarity (Witt et al., 1998). In order to avoid issues and biasness in statistical analysis owing to stationarity these estimations are generated (Nason, 2006). Therefore it is pertinent to utilize unit root tests for determining the integration and stationarity of the variables and later perform further analytical procedures to

the time series data. For this purpose, various tests are available that can be used such as Dickey Fuller DF tests etc. (Dickey and Fuller, 1979). The tests comprise of two opposite hypothesis, the null and alternate hypotheses. The null hypothesis assumes the existence of unit root and non stationarity of time series data while the alternate hypothesis presents missing unit root and stationarity of the acquired data. Unit root tests fail to reject the null hypothesis of a unit root for many economic time series reference (Kwiatkowski et al., 1992).

Once the stationarity and integration has been established, cointegration analysis is executed. The reason to perform this analysis is based upon checking the prospect of the variables included in study to be in long run steady state or not. When data are non-stationary purely due to unit roots, they can be brought back to stationarity by linear transformations. There are many possible tests for cointegration: the most general of them is the

multivariate test based on the vector autoregressive representation (VAR)(Hendry and Juselius, 2000). The Engle–Granger test procedure is based on testing that the variables are stationary. Thus in order to check co-integration we used Engle Granger two-stage test (Engle & Granger, 1987). The main assumption of cointegration is that the non-stationary variables should maintain uniform order of integration. Once these requirements are fulfilled, the respective variables are labelled as cointegrated and there will be long run equilibrium relationship among them. Interpreting cointegration as a long-run equilibrium relation was proposed by Engle and Granger, (1987), whereas equilibrium is representative of the assumption that there is a linear combination of the series to be stationary and hence are in equilibrium, in the cointegrated processes(Corbae and Ouliaris, 1988). Engle Granger two-stage test can be used by employing the following equation:

$$\Delta \widehat{e}_t = \alpha_1 \widehat{e}_{t-1} + \varepsilon_t$$

OR

$$\Delta \widehat{e}_t = \alpha_1 \widehat{e}_{t-1} + \sum_i \alpha_{i+1} \Delta \widehat{e}_{t-1} + \varepsilon_t$$

1.6.2 VAR Model

The cointegrated VAR model provides a framework for studying the long-run economic relations. Vector auto regressions (VARs) were introduced into empirical economics by Sims, (1980), who demonstrated that VARs provide a flexible and tractable framework for analyzing economic time series. (Watson, 1994). After the cointegration and long run relationship analysis, the short run relationship between variables in time series data can be assessed via VAR model. Thus in order to feasibly analyze large-scale macro-models in unrestricted reduced short term relations and state, VAR model treats all variables as endogenous (Sims, 1980). This methodology is utilized when there is no validation or requirement of analyzing long run relationship among the variables. If the unit root test indicates that data is non-stationary, they are typically subjected to first difference and if the first log-difference variables

are stationary they are utilized in the model, while the error correction terms are not valid in the VAR model. The VAR model equation for any two variables of the study can be expressed as follows:

$$\begin{pmatrix} \Delta A_t \\ \Delta B_t \end{pmatrix} = \alpha_0 + \alpha_1 \begin{pmatrix} \Delta A_{t-1} \\ \Delta B_{t-1} \end{pmatrix} + \alpha_2 \begin{pmatrix} \Delta A_{t-2} \\ \Delta B_{t-2} \end{pmatrix} + \dots \\ + \alpha_p \begin{pmatrix} \Delta A_{t-p} \\ \Delta B_{t-p} \end{pmatrix} + \alpha_{p+1} \begin{pmatrix} D_{t-4} \\ D_{t-4} \end{pmatrix} + U_t$$

In this equation, α_0 represents the constant, U_t is the innovation term. The number of lags can be determined by AIC criterion. Since Sims, (1980) pioneering work, the VAR model has become one of the leading approaches employed in analysis of the dynamic economic systems. The results of VAR model provides important knowledge on the relevant variables and their relationships however errors can shift the trends of the output. A p^{th} order of VAR equation can be shown as,

$$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + e_t$$

2. Empirical Results

2.1 Results of Unit Root Test

The results of unit root test are presented in Table 2. In order to validate the stationary or non-stationary status of variables selected for analysis, we performed unit root test on our acquired data. The LLC unit root test (Levin Lin Chu) was selected for this purpose in our study. The VAR system can be transformed into a functional model for variable relation representation only if all the variables are stationary. Thus in order to avoid risk of any biasness in data analysis the following test has been selected. The proposed null hypothesis for this research is that variables based data comprises of unit root and is non stationary and the alternate hypothesis suggest that the data lacks unit root and is stationary by default. The outputs of LLC unit root test presented in Table 2 indicates that the proposed null hypothesis for unit root test for the level portion of our time series data is rejected for the dependent variable FDI and independent variable road infrastructure, with the significance level less than 5% and 1%, and accepted for all the remaining variables, confirming the null

hypothesis that are non-stationary. Thus after analyzing level series and finding that data is non stationary, in order to convert it into stationary data LLC based unit root test was also subjected to first difference series. The generated results reveals that all variables are stationary now since the null hypothesis of our unit root test for all the variables is rejected owing to p value less than 0.001 or 0.005. The first difference series of our time series data is in stationary state and integrated in the same order one. The null hypothesis was rejected with ten percent for road infrastructure, ease of doing business and FDI, while the null hypothesis for quality of railroads, air transports and trade openness has been rejected by five percent significance level. Thus since majority of the variables were non stationary at level series and were first differenced to be converted to stationary form and the order of integration of all the variables is either zero or one.

Table 2: Panel Unit Root Test – LLC

Variable	Level	1 st Difference
Quality of Railroads	-0.5998	-1.2984**
Air Transports	-0.4386	-3.9382**
Road Infrastructure	-1.8905**	-10.5498***
Ease of Doing Business	-5.4982	11.5988***
Trade Openness	-4.6092	-9.5733**
IFI	-2.4837*	-8.9837***

2.2 Results of Cointegration

After the execution of panel unit root test on our time series data, the corresponding variables have been integrated in the same order one. Now for further analysis after integration, the data will be analyzed for co-integration. The reason to perform this analysis is based upon checking the prospect of the variables included in study to be in long run steady state or not. Thus in order to check co-integration Dickey Fuller and augmented Dickey Fuller denoted DF and ADF tests were performed. The outputs of the cointegration test have been demonstrated in Table 3. The cointegration outputs reveal that the null hypothesis is rejected for all six variables and no cointegration can be assumed for the variables being analyzed in this research. This test suggest that no long run relationship exist between the variables. This

output also confirms that there is no linear combination between any two variables included in this analysis and they are not integrated in the long run.

Table 3: Cointegration Test

Cointegration	Q	A	R	E	D	I
Dickey Fuller	-4.727	-1.371	-3.176	-0.137	-2.493	-2.583
Augmented DF	-3.284	-8.387	-4.287	-3.284	-5.487	-2.763

2.3 Results of VAR model

In order to determine short run relationship between the proposed variables in this study, they were subjected to VAR modeling. The outputs of this model are generated and displayed in Table 4. The obtained F-statistic values are greater than 1 for all variables indicating significance of the model outputs. The R square values are also close to one, thus ensuring significant variance in between variables in this study. The t values are presented in Table 4 to indicate significant impact of variables on each other. This conventional model assesses the significant relation between these variables as function of indirectly impacting the direct variable FDI. The results indicate that first independent variable Quality of railroads (Q) share significant relation with Trade openness (D) since t value is greater than 1.96. This impact is positive, which can be interpreted as that a 1% increase in railroad quality will result in enhanced 0.25 % increase in trade openness, proposing a direct relation between the two variables. Similarly Air transports (A) also has a significant and positive impact on Trade openness (D) with its 1% increase resulting in 0.45% increase in Trade openness. Road infrastructure (R) again shared a significant and positive impact with Trade openness (D). Ease of doing business (E) did not significantly impact any other variable either positively or negatively. The control variable Trade openness (D) simultaneously exercised positive impact on all remaining four independent and control variables and shared significant short run relationship with them. Thus it can be proposed that all variables play a significant part in this study and share significant relations in a progressive direction. Trade openness positively and dominantly effects all

other variables and is an indicator of increased FDI indirectly by influencing and being influenced by other variables such as Quality of railroads (Q), Road infrastructure (R) and Air

transports (A) in this study. The cumulative growth and positive relation of these factors contribute to overall FDI in the country.

VAR Estimates	Q	A	R	E	D
Q (-1)	1.622616 (2.43146)	0.124515 (0.26845)	0.074918 (0.28305)	0.402123 (0.41056)	0.250345 (126.018)
Q (-2)	0.795480 (1.87280)	0.160686 (0.20677)	0.207966 (0.21801)	0.172588 (0.31623)	0.056323 (97.0638)
A (-1)	4.129320 (4.86741)	0.453193 (0.53740)	0.910879 (0.56662)	0.670295 (0.82188)	0.453423 (252.269)
A (-2)	0.932733 (4.84549)	0.776303 (0.53498)	0.390352 (0.56407)	0.195639 (0.81818)	258.0998 (251.133)
R (-1)	3.536585 (2.97003)	0.201447 (0.32791)	0.285819 (0.34574)	0.298333 (0.50150)	3.711998 (153.931)
R (-2)	0.238783 (3.31849)	0.496526 (0.36638)	0.341241 (0.38631)	0.195657 (0.56034)	0.008319 (171.991)
E (-1)	0.012338 (0.00742)	0.001241 (0.00082)	0.001252 (0.00086)	0.002683 (0.00125)	0.386310 (0.38470)
E (-2)	0.007191 (0.00899)	0.000491 (0.00099)	0.000389 (0.00105)	0.001376 (0.00152)	0.249647 (0.46588)
D (-1)	35.44410 (52.6891)	5.489825 (5.81725)	1.923375 (6.13358)	0.921893 (8.89675)	0.000936 (2730.78)
D (-2)	51.01486 (46.7691)	7.385864 (5.16364)	1.462111 (5.44442)	9.088007 (7.89713)	0.097615 (2423.96)
C	1233.246 (732.641)	176.2460 (80.8888)	47.91004 (85.2872)	138.1421 (123.709)	17.876782 (37971.4)
R-squared	0.756756	0.942982	0.818362	0.713382	0.883947
Adj. R-squared	0.464863	0.874559	0.600396	0.369441	0.964683
F-statistic	2.592581	13.78182	3.754547	2.074139	51.07709

Table 4: Vector Auto-regression Estimates

Response CC to Independent and Control Variables

In the final portion of our estimations we are going to analyze and interpret the responses of all independent and control variables of this study such as independent variable quality of railroad, quality of air transport and quality of road infrastructure and the control variables, ease of doing business and trade openness to the shocks driven by the dependent variable, foreign direct investment FDI. The outputs have been represented in Figure 1. In each output a limit has been denoted in accordance with the shock generated by foreign direct investment FDI. This

limit is demonstrated by means of a red dotted line in the plotted graphs. The responses of independent and control variables are demonstrated by means of blue solid lines in graphical presentation. The generated outputs are interpreted as proof of smooth response of independent and control variables towards dependent variable when the graphically represented response line stays within the prescribed limit of the study. In case the response line crosses the barrier, it will indicate errors and incorrect results. Therefore, it is crucial to ensure that the response line follows the protocol and

stay in between the limits. As clearly shown in Figure 1 the blue line had stayed within the limit for all responses and at no point crossed it for any variable.

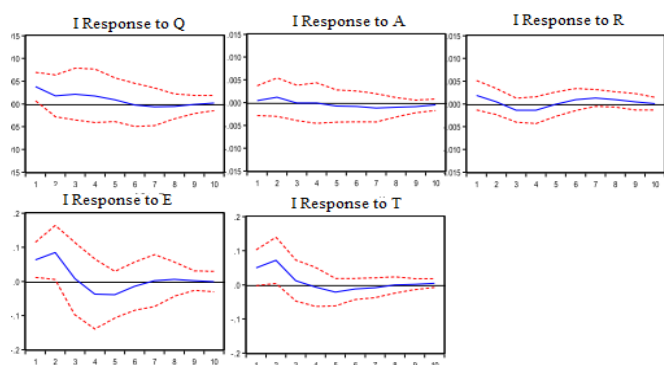


Fig 4: Response CC to Independent and Control Variables

DISCUSSION AND CONCLUSION

2.4 Discussion

The above analysis were designed and executed with the intention to meet the objective of this study and analyze the effect of independent variables quality of railroad, quality of air transport and quality of road infrastructure and the control variables, ease of doing business and trade openness on the dependent variable, foreign direct investment FDI. The hypothesis generated assumed significant impact of independent variables and significant role of mediating variables on foreign direct investment FDI. The first hypothesis of our study was that quality of railroads significantly impact FDI, this hypothesis was proved by our analysis since a positive impact of railroad quality on FDI is proposed by the VAR model. According to Chen, (1996) Interregional railroad connections are found to be positively related to of FDI. Our second hypothesis of this study was that FDI is significantly impacted by quality of air transport. This hypothesis was also found true and a positive relation impact was found through our analysis. Head and Ries, (1996) showed in their study that the larger Chinese cities with good ports and strong industrial bases benefited most from the Open Door policy. These cities attracted the most foreign investments and they also received the greatest increase in

investment. The third hypothesis was that quality of road infrastructure had significant impact on FDI. This hypothesis was also proven true through our analytical findings. Sun et al., (2002) confirmed in his study that labor quality and infrastructure are very important determinants of the distribution of FDI. High labor quality and good infrastructure attract foreign investors. The two control variables ease of doing business and trade openness were also assessed in terms of their mediating role towards influencing FDI. A study by Agiomirgianakis et al., (2003) on factors that may attract FDI via a panel data regression analysis for a sample consisting of 20 OECD countries for 23 years (1975-1997) suggested that variables such as human capital and the density of infrastructure appear to be important. Both control variables showed significant impact, however trade openness was found highly influencing in regulating positive relations with other independent variables to effect FDI indirectly. The degree of a country's openness can affect FDI in multiple ways. Lower import barriers discourage tariff-jumping FDI but stimulate vertical FDI by facilitating the imports of inputs and machinery (Jaumotte, 2004). Thus all the hypothesis in this study have been proved and positive impacts of the three independent variables and control variables on dependent variable has been found true for our research.

CONCLUSION

This study was designed to assess the impact of infrastructure towards foreign investment in Thailand. The role of quality of railroad, air transport and road infrastructure were studied and analyzed individually against foreign investment. For this purpose three major objectives were devised which poses questions with regard to the nature and significant level of impact these three forms of infrastructure exercised on foreign direct investment. In order to confirm or reject the hypothesis data was collected from World Bank database and Global Economy database for all dependent and independent variables. For data analysis Vector auto regressions (VARs) based

model was applied to collected data for determining long and short run economic relations among variables. The time series data was subjected to root test and cointegration test to make it stationary and integrated for VAR model. The outputs revealed that all the hypothesis in this study have been proved and positive impacts of the three independent variables and control variables on dependent variable has been found true for our study area. These determinants and specifically control variable trade openness played a significantly positive role in influencing and attracting FDI in context of China.

2.5 Implications

Infrastructure has its own importance for any country in various aspects. In this regard, one may identify different theoretical, practical and policy making implications of this study. This study provides a complete package of literature and information about the concepts of quality of different aspects of infrastructure such as railroads, air transport and roads as well as their impact on the inward foreign direct investment. Authors may acquire this information for various purposes in their studies. In addition, thus study may also guide the officials of the government to maintain the quality of railroads, air transport and roads so that the conditions of FDI may get better and its attraction increases in the country. This study may also provide assistance to the government for the purpose of devising policies that favor the maintenance of quality of railroads, air transport and roads so that these aspects may increase the amount of FDI in the country that may be helpful in various aspects.

2.6 Limitations and Future research indications

Several limitations related to sample size, tests used, country of study and variables used can be identified in this study. All of them can be took up be the future researchers and can be eradicated effectively. As it is clear that sample size of the collected data used in this study is very limited and must be increased by the future researchers. In addition, as this study is specific to Thailand,

future researchers may also use any other country and collect time series data about that. In this study, a few typical and specific tests and techniques related to time series analysis have been used. However, other researchers may also employ other time series related tests in their studies that will improve the quality as well as enhance the accuracy and authenticity of their researches. In the last, it must be noted that only three aspects of infrastructure have been studied in this research. Other infrastructure aspects as well as other variables may also be used by other authors in their studies.

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