Chapter 3

Modeling International Demand to Thailand: Spatial and Temporary Aggregation Using Panel Data

Many countries, especially developing ones, have recently turned to tourism in the hope of capitalizing on perceived benefits. These include the exposure of a given economy to hard foreign currency that can alleviate gaps in foreign exchange and current account balances, and the possibilities of decreasing unemployment and increasing national and per-capita incomes. Tourism industry had major role in economics development of Thailand over the past 40 years. Thailand had been placed among the most popular tourist destinations in top 20 of the world. There is few research in Thailand applying econometric model forecasting for international tourist demand, especially in solution with method panel data. These findings help marketers and tourism authorities to identify their promotion and positioning strategies to the right target market.

Panel data analysis is a method of studying a particular subject within multiple sites, periodically observed over a defined time frame. Within the social sciences, panel analysis has enabled researchers to undertake longitudinal analyses in a wide variety of fields. With repeated observations of enough cross-sections, panel analysis permits the researcher to study the dynamics of change with short time series. The combination of time series with cross-sections can enhance the quality and quantity of data in ways that would be impossible using only one of these two dimensions (Gujarati, 638). Panel analysis can provide a rich and powerful study of a set of people, if one is willing to consider both the space and time dimension of the data.. This chapter is a revised version from the original panel data paper presented at the Second Conference of The Thailand Econometric Society, Chiang Mai, Thailand in Appendix A in 5 – 6 January 2009.

ABSTRACT

Tourism activities in Thailand are responsible for about 6% of the Thai GDP. Additional receipts from tourism contribute substantially in financing the current account deficit of the balance of payments. These are convincing arguments to justify a careful analysis to forecast international tourism demand to Thailand. These findings will help marketing and tourism authorities focus promotions and positioning for the appropriate target markets. Using annual data from 1981–2007, the nature of short run and long run relationships was examined empirically by estimating a static linear-fixed and random-effect model and difference transformation dynamic model. A very important finding was that in the long run, the coefficients are sensitive in significance to the real per capita GDP, the nominal exchange rate of the tourist's original country to Baht per dollars, the relative price to reach Thailand by individuals coming from their original country, and also to transport costs to reach Thailand by individuals coming from their original country, and present expected signs**.** One of the main conclusions of the study is the significant value of the lagged dependent variable in dynamic panel data, which may be interpreted as a minor word-of-mouth effect on the consumer decision in favor of the destination. The government, the TAT (Tourism Authority of Thailand), and the private sector should be monitored more carefully for

every condition related to tourism which may create cause tourists to have a negative image of Thailand during their travel**s.**

Keywords: International Tourism, Static Fixed Effects Model, Dynamic Panel Data Model.

3.1 Introduction

The tourism industry has had a major role in the economic development of Thailand over the past 40 years. From 1987 to 2006, arrivals of international tourists in Thailand have increased by an excellent level. Thailand has been placed among the top 20 most popular tourist destinations in the world. International tourists to Thailand increased from 3.48 million in 1987 to 13.82 millions in 2006. The national income of Thailand from the tourism industry was ranked second only to income from commercial exports in 2006. The income received from international tourists was 50,024 million Baht and accounted for 3.85% of GDP in 1987, and changed to 7,813,050 million Baht, accounting for 6.23% of GDP in 2006 (Table 1). Grouping by nationality of international tourists to Thailand during 1971 to 2005 shows tourists from East Asia (56.29%), Europe (24.87%), United States of America (7.44%), South Asia (4.36%), Oceania (4.18%), Middle East (2.10%), and Africa (0.76%), respectively. (Figure 1)

In Asia (2007), the ranking of international tourists who came to Thailand was ranked second behind China in the tourism market.

From 1981–2007, the original countries that sent the most numbers of international tourists to Thailand were Malaysia, with the highest average number of 1,578,632 (11.42(%, and Japan with 1,293,313 (9.36%). Korea came third with

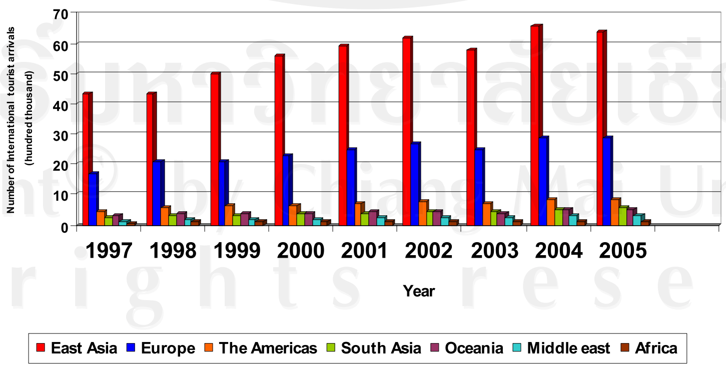
1,101,525 (7.97%), and China came fourth with 1,033,305 (7.48%). The top 10 ranking countries of international tourists to Thailand are Malaysia, Japan, Korea, China, Singapore, United Kingdom, United States of America, Australia, Germany, and Taiwan, respectively. (Table 1) Numbers of tourists from these countries have also been continuously growing during the period of 1981–2007. (Figure 2) So far, most research on tourism demand and the international flow of tourism have focused on explaining tourism demand and flows in developed countries, with little reference to developing countries, and even less to explaining tourism in Thailand. This research is an attempt to fill these voids, and aims to use panel data econometrics to explain the determinants of tourism to Thailand. There is also a small amount of research in Thailand applying econometric model forecasting for international tourist demand, especially in solution with method panel data. Hsiao (2003) indicated that, compared with the use of time series or cross section data, the use of pooled time series and cross section data has several advantages, such as greater degrees of freedom, the mitigation of multi-collinearity, a reduction in omitted variable bias, and hence, an improvement in the accuracy of parameter estimation. Therefore, empirical analysis exploits the panel structure of the data set, for the top ten countries which send 63.16% of the international tourists who have come to Thailand during the period of 1981 to 2007, to estimate the determinants of international tourism demand to Thailand.

Table 3.1 Average numbers of international tourists to Thailand during the years 1981–2007

Rank	Name of Country	Average Numbers of Tourists	%
1	Malaysia	1,578,632	11.42
2	Japan	1,293,313	9.36
3	Korea	1,101,525	7.97
4	China	1,033,305	7.48
5	Singapore	818,162	5.92
5	U.K.	745,525	5.39
6	U.S.A.	640,674	4.64
8	Australia	538,490	3.9
9	Germany	507,942	3.67
10	Taiwan	472,851	3.42
International Tourists from the Top 10 countries		8,730,419	63.16
Total International Tourists		13,821,802	100

Source: Tourism Authority of Thailand (TAT)

Figure 3.1 International Tourist Arrivals to Thailand by Nationality



Source: Tourism Authority of Thailand (TAT)

Figure 3.2 Top Ten International Tourist Arrivals to Thailand during 1981–2007.

Source: Tourism Authority of Thailand (TAT)

In order to investigate the determinants of international tourism demand to Thailand, static panel data models using fixed effect and random effect estimators were implemented, while dynamic panel data models adopted the generalized method of moments (GMM), estimator (panel GMM procedures), and panel GMM of Arellano and Bond (1991). These findings help marketers and tourism authorities to focus their promotions and positioning strategies to the right target markets. The remainder of the paper is organized as follows: Section 2 introduces the data set and the econometric approach to be followed, while the results of empirical estimation are presented in Section 3. Policy implications and some concluding remarks are given in Section 4.

3.2 Data and Empirical Methodology

3.2.1. Data

This paper uses time series data from 1981–2007 for the top ten source countries of international tourists to Thailand, which include Malaysia, Japan, Korea, China, Singapore, U.K., U.S.A., Australia, Germany and Taiwan. International tourism demand is usually measured by proxies such as the number of foreign visitors, the volume of earnings generated by foreign visitors, and the number of nights spent by visitors from abroad. Consequently, we use the number of foreign visitors, namely international tourist arrivals, to estimate international tourism demand to Thailand**.** Yearly data for international tourist arrivals collected from statistical data sets for each country have been obtained from the World Tourism Organization or Tourism Authority of Thailand (TAT). The sample period is from the years 1981 to 2007. The panel models are estimated by using fixed effects or random effect for static models and panel GMM procedures and GMM procedures of Arellano and Bond (1991) for dynamic models.

We use dependent variables DT for the total number of tourist arrivals per annum to a particular destination to measure the demand for tourism to Thailand. The key independent variables in equations are Real GDP per capita in country of origin or tourism disposable income of individuals coming from origin country (Y_{it}). This variable is the approximated income with origins' per capita GDP at constant prices. Data are taken from GDP per capita from the United States Department of Agriculture, Economic Research Service, and International macroeconomic data sets.

As far as relative prices are concerned, it is common in tourism demand studies to use the CPI of a destination country for relative tourism prices. The inverse of this shows how many “baskets” of goods a tourist has to give up in his home country in order to buy a basket of goods in the destination country (RP_{it} = CPI Thailand / CPI origin country), obtained data from IMF and BOT (Bank of Thailand). The other independent variables also include the nominal exchange rate of the original country to which the value to Thai Baht per dollar is modified (ER_{it}), obtained from United States Department of Agriculture, Economic Research Service international, and macroeconomic data set. Transportation costs from origin country *i* to Thailand, or transport costs to reach Thailand by individuals coming from the original country (TC_{it}). Since information on bilateral transport costs were unavailable, this variable is approximated with Jet Fuel (Dollar)/CPI origin. Data is taken from the United States Energy Information Administration (2007) Rotterdam (ARA) Kerosene-Type Jet Fuel Spot Price FOB.

3.2.2. Empirical Methodology

The primary purpose of the paper is to detect the most significant factors affecting the flow of international tourists by country of origin. Panel data models were constructed by using yearly data corresponding to the top ten countries sending international tourists to Thailand. The use of this type of data enables a relatively large number of observations to be had, and a concomitant increase in the degrees of freedom, thereby reducing collinearity and improving the efficiency of the estimates (Song and Witt, 2000). In this paper, balanced panel data sets are used**.** Garín-Muñoz and Pérez-Amaral (2000) suggested that tourism has a great deal of inertia, so that the dynamic structure of consumer preference should be considered in the tourism demand model (Garín-Muñoz, 2006). In particular, if the impact of previous tourism is neglected, the estimated results of other relevant variables will be overestimated. Furthermore, Song and Witt (2000) noted that the static regressions of tourism demand models might raise some significant problems, such as structural instability, forecasting failures and spurious regression. Hence, including the lagged dependent variable in a dynamic model of tourism demand is one way of sensibly accommodating the dynamic structure of consumer preferences, where changes in tastes might be regarded as endogenous (Garín-Muñoz and Pérez-Amaral, 2000; Garín-Muñoz, 2006; Ledesma-Rodríguez, Navarro-Ibáñez and Pérez- Rodríguez, 2001). In our paper, the lagged dependent variable of tourism demand, which will be interpreted as being based on habit formation or as interdependent preferences, are included as regressors to consider the possibility of a change in consumer preferences over time.

The model to be estimated as a Static model is given as:

$$lnDT_{it} = a_i + y_1 \ln Y_{it} + y_2 \ln RP_{it} + y_3 \ln ER_{it} + y_4 \ln TC_{it} + \lambda_{it} + \mu_{it} + \varepsilon_{it} \quad \text{(Eq. 1)}$$

In equation (1), i refers to factors affecting the flow of international tourists by country of origin, and $t=1,...,T$ represents the time period. λ is a year-specific intercept, μ is as unobserved country-specific effect ($E(\mu_i) = 0$), and ε_{it} is the disturbance term. It is assumed that ε_{it} is serially uncorrelated, with zero mean and independently distributed across countries, but there are no restrictions on heteroskedasticity across time and countries. A positive sign is expected for the coefficients y_1 and y_3, while a negative sign is expected for the coefficients y_2 and y_4. The variables used in equations (1) can be summarized in Table 4.

Using panel data allows one not only to investigate dynamic relations, but also to control for unobserved cross-section heterogeneity. With panel data, the issue is whether to use a random-effects or fixed-effects estimation approach. The random effects approach to estimating y exploits the correlation in the composite error in equation (6), $vjt = cit + \varepsilon_{it}$, $cit = \lambda_{it} + \mu_{it}$. The approach puts ci in the error term assuming that ci is orthogonal to xjt and use a Generalised Least Squares (GLS) estimator to take into account serial correlation in the composite error vjt. There can, however, be many instances where this assumption is violated. Specifically, cj can be correlated with xjt in the present model if the cj influences the price, exchange rate and income variables. In such a case, the fixed-effects estimator may be more appropriate to use. Wooldridge (2001:266) shows that a fixed effect estimator is more robust than a random effects estimator. A shortcoming of the approach is, however, that time-constant factors, such as geographical factors, cannot be included in xjt, otherwise there would be no way to distinguish the effects of these variables from the effects of the unobservable cj. Another shortcoming of the fixed effects estimator is that it is less efficient than the random effects estimator – it has less degree of freedom and takes into calculation only the variation "within" units, and not between units. Accordingly, to determine which of these estimators are more appropriate to use in the present case, both a fixed effects (FE) and random effects (RE) estimator were initially used to estimate equation and the Hausman specification test done to evaluate the assumption in the random effects model that cj is orthogonal to xjt. Rejection of the null hypothesis would lead to rejection of the random effects estimator. The results of the Hausman Specification Tests are summarized in Tables 7 and 8 below.

In the dynamic panel estimation we included the lagged values of DT in order to capture the quality of the experience of the tourist to a particular destination, which will also serve as an indicator of how suitable the tourism products in that country are for the particular market segment**.**

The model to be the estimated Dynamic model is given as:

$$\ln DT_{it} = a_i + y_1 \ln Y_{it} + y_2 \ln RP_{it} + y_3 \ln ER_{it} + y_4 \ln TC_{it} + y_5 \ln DT_{it-1} + \lambda_{it} + \mu_{it} + \varepsilon_{it} \quad \text{(Eq.2)}$$

Owing to the unavailability of suitable data to capture economic and social structures, there are other factors that are hypothesized to affect tourism demand but which have been omitted from the analysis. If certain variables excluded are correlated with the dependent variable, subsequently, the estimation results are subject to omitted variable bias. The panel data models were used in the paper in order to reduce the possible omitted variable bias.

However, autocorrelation may arise in a dynamic panel data model due to the inclusion of a lagged dependent variable, as well as individual effects characterizing the heterogeneity among the individuals (Baltagi, 2001). Since $\ln DT_{it}$ is a function of μ_{it}, it immediately follows that DT_{it-1} is also a function of μ_{it}. Therefore, DT_{it-1}, an explanatory variable in equation (2), is correlated with the error term. Garín-Muñoz (2006) noted that, when lagged dependent variables are included as regressors, not only is the OLS estimator biased and inconsistent, but the within groups (WG) and random effects estimators are also biased and inconsistent. One solution to avoid the bias and inconsistency is to use the first difference transformation, and to treat the lags of the dependent variables as instruments for the lagged dependent variable (Garín-Muñoz, 2006; Ledesma-Rodríguez, Navarro-Ibáñez and Pérez- Rodríguez, 2001).

A generalized method of moments (GMM) approach can be used to unify the estimator and eliminate the disadvantages of reduced sample sizes. As suggested by Arellano and Bond (1991), the list of instruments can be exploited by additional moment conditions and allowing the number to vary with *t,* so that all moment conditions can be estimated by GMM. However, the GMM estimator for γ is asymptotically normal, based on the assumptions of homoskedastic and uncorrelated errors term. In this paper, the GMM approach is used to compute the panel GMM and GMM-DIFF estimator. The first difference transformation model, namely GMM-DIFF estimator, as suggested by Arellano and Bond (1991), is based on taking first differences to eliminate the individual effects, and regard the dependent variable lagged two or more periods as instruments for the lagged dependent variable. The solution used in this paper was to implement the GMM procedure of Arellano and Bond (1991). The GMM-DIFF method of Arellano and Bond (1991) was used to investigate the impacts of international tourism demand to Thailand.

The dynamic and first difference versions of the tourism demand model are given as follows:

$$\Delta \ln DT_{it} = y_1 \Delta \ln Y_{it} + y_2 \Delta \ln RP_{it} + y_3 \Delta \ln ER_{it} + y_4 \Delta \ln TC_{it} + y_5 \Delta \ln DT_{it-1} + \Delta \lambda_{it} + \Delta \mu_{it} + \Delta \varepsilon_{it} \quad \text{(Eq.3)}$$

where $\Delta \ln DT_{it} = \ln DT_{it} - \ln DT_{it-1}$, and analogously for the remaining variables. It should be mentioned that using a dynamic panel model will generate more precise results by differencing the data and by removing the problem of non-stationarity

(Garín-Muñoz, 2006). Estimating equation (3) by OLS does not lead to a consistent estimator for γ because ln DT_{it-1} and ε_{it-1} are correlated, even as $T \rightarrow \infty$. However, an instrumental variable approach, whereby ln DT_{it-2} or ln DT_{it-2} -.ln DT_{it-3} can be used as instruments, leads to consistency as ε_{it} is not autocorrelated (Anderson and Hsiao, 1981). However, a second instrumental variables estimator requires an additional lag to construct the instrument, such that the effective number of observations used in estimation is reduced. Additionally, In order to support the use of the difference transformation in the dynamic model (equations (2) and (3)), we implement panel unit root tests using the Levin, Lin and Chu (2002) and Breitung (2000) methods. The latter test assumes a common unit root process, while the LLC test, and Maddala and Wu (1999) and Choi (2001) ADF-Fisher Chi-square PP-Fisher Chi-square tests assume separate unit root processes, and assumes that each individual unit in the panel shares the same AR(1) coefficient, but allows for individual effects, time effects and possibly a time trend. It may be viewed as a pooled Dickey-Fuller or an Augmented Dickey-Fuller (ADF) test, with the null hypothesis of non-stationarity, or I(1). After transformation, the t-star test statistic is asymptotically distributed as a standard normal under the null hypothesis of non-stationarity. As for the LLC test, Maddala and Wu (1999) and Choi (2001), ADF-Fisher Chi-square PP-Fisher Chi-square tests are based on the mean of the individual Dickey-Fuller t-statistics of each unit in the panel, and lagged dependent variables may be used to accommodate serial correlation in the errors. After transformation these statistics are asymptotically distributed as standard normal under the null hypothesis of non-stationarity. The results of the panel unit root tests are reported in Tables 5 and 6. Table 6 shows the results of all tests for which the null hypothesis of a unit root is rejected for the levels of annually all-variable. However, for the series of first differences, the null hypothesis of a unit root are all rejected .

3.3 Empirical Results

This section presents the results of the static and dynamic models for investigating the effects of factors affecting the flow of international tourists by country of origin to Thailand. We first present the estimates of the static linear fixed effects model discussed in sub-section 3.1, and then present the estimates of the difference transformation dynamic model discussed in sub-section 3.2. The results of the static fixed and random effect model are presented in Table 2.The results of the dynamic difference model are presented in Table 3. As for the static model, Table 2 gives the results of the determinants of international tourism demand to Thailand.

3.3.1. Static model

Initially, a static version of the model is estimated, that is, a model without the second term in equation (1). Table 2 shows the results of a static panel model for investigating the effects of factors affecting the flow of international tourists by country of origin to Thailand. The presence of cross-section and period-specific effects terms λ_{it} and μ_{it} may be handled using fixed or random effects methods. You may, with some restrictions, specify models containing effects in one or both dimension, for example, a fixed effect in the cross-section dimension, a random effect in the period dimension, or a fixed effect in the cross-section and a random effect in the period dimension. Note, in particular, however, that two-way random effects may only be estimated if the data is balanced so that every cross-section has the same set of observations. Random effects for which the random effect specifications assume that the corresponding effects λ_{it} and μ_{it} are realizations of independent random variables with mean zero and finite variance. Most importantly, the random effects specification assumes that the effect is uncorrelated with the idiosyncratic residual ε_{it}.

The result in static panel data with period random and idiosyncratic random to estimate the determinants of tourism demand form a total number of international tourist arrivals from the top ten countries to Thailand (DTit). All coefficients are sensitive in significance to real per capita GDP, nominal exchange rate of original country to Baht per dollars, transport costs to reach Thailand by individuals coming from their home countries, and also sensitive to the relative price to reach Thailand by individuals coming from their home countries and present expected signs. As an increase in origins' real per capita GDP, and an increase in nominal exchange rate of original country to Baht per dollars, leads to an increase in total number of tourist arrivals from original country to Thailand, on average an *ceteris paribus*. On the other hand, an increase in transport costs to reach Thailand by individuals coming from their home country and in relative price to reach Thailand by individuals coming from original country causes a reduction in the total number of tourist arrivals to Thailand, on average and *ceteris paribus*.

When comparing the result with cross-section, period and idiosyncratic random effects, all the coefficients are sensitive in significance to real per capita GDP, and also sensitive to the nominal exchange rate of the original country to Baht per dollars, relative price to reach Thailand by individuals coming from their original country, transport costs to reach Thailand by individuals coming from their original country, and also present expected signs to consider an adjusted R-squared quite low at 0.680 and Durbin-Watson 0.129. The Durbin-Watson statistic in output is very close to zero, indicating the presence of serial correlation in the residuals. From the result with cross-section, period and idiosyncratic random effects, a 1% increase in origins' real per capita GDP leads to a 1.865% increase in the total number of tourist arrivals to Thailand, on average an *ceteris paribus*. A 1% increase in transport costs to reach Thailand by individuals coming from their home country leads to a 0.054% decrease in the total number of tourist arrivals to Thailand, on average and *ceteris paribus,* and a 1% increase in relative price to reach Thailand by individuals coming from another country leads to a 0.630% decrease in the total number of tourist arrivals to Thailand. Finally, a 1% increase in the nominal exchange rate of original country to Baht per dollars causes a 0.189% reduction in the total number of tourist arrivals, on average and *ceteris paribus*.

The fixed effect results in Cross-section fixed (dummy variables) and Period fixed (dummy variables) effects all the coefficients are sensitive in significant to real per capita GDP, nominal exchange rate of original country to Baht per dollars, the relative price to reach Thailand by individuals coming from their original country and also to transport costs to reach Thailand by individuals coming from other countries and present expected signs with adjusted R-squared quite high at 0.938 and Durbin-Watson 0.370. A 1% increase in origins' real per capita GDP, leads to a 1.292% increase in total number of tourist arrivals in original country to Thailand, on average an *ceteris paribus*. A 1% increase in transport costs to reach Thailand by individuals coming from other countries leads to a 0.121% decrease in the total number of tourist arrivals to Thailand, on average and *ceteris paribus*, and a 1% increase in relative price to reach Thailand leads to a 2.242% decrease in the total number of tourist arrivals to Thailand. Finally, a 1% increase in the nominal exchange rate of original country to Baht per dollars causes a 0.714% reduction in the total number of tourist arrivals to Thailand, on average and *ceteris paribus*.

When comparing the results with other fixed effect to cross-section fixed (dummy variables), period random and idiosyncratic random effects, all the coefficients look similar to the former fixed effects with strong sensitivity to real per capita GDP, nominal exchange rate of original country to Baht per dollars, relative price to reach Thailand by individuals coming from other countries, and also sensitive to transport costs to reach Thailand, and present expected signs, consider to both Adjusted R-squared and Durbin-Watson quite a litter bit lower at 0.903 and 0.339.

Table3.2 The Log linear Static panel data in dependent total number of tourist arrivals from the top ten countries to Thailand (DT_{it}).

Variable	RE Effect	RE-RE Effect	FE–FE Effect	FE-RE Effect
Constant	10.85955*** (0.156)	-5.294488*** (0.795)	-1.413860*** (1.197)	-9.432369*** (0.480)
LNY	0.135659*** (0.015)	1.864949*** (0.085)	1.292380*** (0.118)	2.131409*** (0.054)
LNTC	-0.086230*** (0.019)	-0.053838* (0.033)	-0.120760* (0.052)	-0.040934** (0.019)
LNRP	-0.884250** (0.096)	-0.629971** (0.233)	-2.241699*** (0.187)	-2.090006*** (0.178)
LNER	0.047256*** (0.008)	0.189286** (0.089)	0.714638*** (0.104)	1.011712*** (0.087)
Adjusted R-squared	0.119	0.680	0.938	0.903
Period random (SD)	0.048	0.048	-	0.048
Cross-section random(SD)	-	0.409	-	-
Idiosyncratic random(SD)	0.252	0.252	-	0.252
Period random (Rho)	0.035	0.010	-	0.035
Cross-section random(Rho)	-	0.718	-	-
Idiosyncratic random (Rho)	0.965	0.272	-	0.965
Durbin-Watson stat	0.050	0.129	0.370	0.339

*Standard errors are in parentheses; *** denotes significance at the 1% level,*
*** denotes significance at the 5% level , * denotes significance at the 10% level.*

3.3.2 Dynamic Model

1. Panel GMM (Panel Generalized Method of Moments)

The GMM estimator belongs to a class of estimators known as M-estimators that are defined by minimizing some criterion functions. GMM is a robust estimator in that it does not require information of the exact distribution of the disturbances. GMM estimation is based upon the assumption that the disturbances in the equations are not correlated with a set of instrumental variables. The GMM estimator selects parameter estimates so that the correlations between the instruments and disturbances are as close to zero as possible, as defined by a criterion function. By choosing the weighting matrix in the criterion function appropriately, GMM can be made robust to heteroskedasticity and/or autocorrelation of unknown form. The GMM estimator, based upon the conditions that each of the right-hand side variables, is uncorrelated with the residual.

Table 3.3 Panel Generalized Method of Moments in dependent total number of tourist arrivals from the top ten countries to Thailand (DT_{it}).

Variable	FE Effect	RE Effect	FE-RE Effect	GMM-DIFF
Constant	2.090349*** (0.541)	0.460826*** (0.164)	-0.181797 (0.250)	
LNY	-0.377685*** (0.101)	-0.027035*** (0.011)	0.127441 (0.078)	1.958955*** (0.250)
LNTC	-0.013560 (0.025)	-0.029250 (0.024)	-0.093100** (0.038)	-0.011790 (0.043)
LNRP	0.055289 (0.071)	-0.003970 (0.006)	-0.366192** (0.142)	-0.940028* (0.441)
LNER	-0.121023 (0.147)	-0.031100 (0.070)	0.199831*** (0.070)	0.325587** (0.135)
LNDT(-1)	1.105386*** (0.042)	0.980193*** (0.012)	0.859682*** (0.033)	0.096031*** (0.031)
Adjusted R-squared	0.968	0.973	0.968	
Durbin-Watson stat	1.857	1.869	1.769	

*Standard errors are in parentheses; *** denotes significance at the 1% level. ** 5% level * 10% level, t ratios in parentheses. Method of estimation: GMM-DIFF of Arellano and Bond.(1991) t ratios in parentheses. Estimates are obtained using instruments DT_{it} lagged in one and six periods.*

The Panel GMM EGLS fixed effect result to estimate the determinants of tourism demand form total number of international tourist arrivals to Thailand from the top ten countries (DT_{it}) in Cross-section fixed (dummy variables) is sensitive in significance to real per capita GDP but doubtfully present unexpected signs, since 1% increase in origins' real per capita GDP, leads to a 0.378 % decrease in the total number of tourist arrivals to Thailand, on average an *ceteris paribus*, but coefficients is sensitive in significant to number of tourist arrivals in original top ten country to Thailand who got an experienced to Thailand in the past year as 1% increase in number of tourist arrivals in original top ten country to Thailand last year leads to a 1.105 % increase in total number of tourist arrivals in original country to Thailand, on average an *ceteris paribus* consider to adjusted R-squared quite high at 0.968 and Durbin-Watson 1.857.

When comparing the results with Panel GMM EGLS with Cross-section random, period random and idiosyncratic random effects coefficients is sensitive in significant to real per capita GDP but also doubtfully present unexpected signs, since a 1% increase in origins' real per capita GDP leads to a 0.027% decrease in the total number of tourist arrivals to Thailand, on average an *ceteris paribus*, but coefficients are sensitive in significant to number of tourist arrivals from the top ten countries to Thailand who had an experience in Thailand in the past year, with a 1% increase in the number of tourist arrivals from the top ten countries to Thailand last year leads to a 0.980% increase in total number of tourist arrivals in original country to Thailand, on average an *ceteris paribus*, consider to adjusted R-squared quite high at 0.973 and Durbin-Watson 1.869.

The result with Panel GMM EGLS with cross-section random, period random, and idiosyncratic random effects coefficients is sensitive in significance to transport costs to reach Thailand by individuals coming from other countries, and also relative to the price to reach Thailand by individuals coming from original countries, and the nominal exchange rate of the original country to Baht per dollars, and present with expected signs, since 1% increase in transport costs to reach Thailand by individuals coming leads to a 0.012% decrease in total number of tourist arrivals in original country to Thailand, on average an *ceteris paribus* and 1% increase in relative price to reach Thailand by individuals coming from other countries leads to a 0.940% decrease in the total number of tourist arrivals. A 1% increase in nominal exchange rate of original country to Baht per dollars causes a 0.325% increase in the

total number of tourist arrivals to Thailand, on average and *ceteris paribus*. Finally a 1% increase in the total number of tourist arrivals from the top ten countries to Thailand in the past year leads to a % increase in total number of tourist arrivals to Thailand, on average an *ceteris paribus*, consider to adjusted R-squared quite high at 0.968 and Durbin-Watson 0.860.

2. GMM-Diff

The results of the GMM-DIFF method of Arellano and Bond (1991) to estimate the determinants of tourism demand form total number of international tourist arrivals in original top ten country to Thailand ($\mathbf{DT}_{it}$) are shown in Table 3. The consistency and accuracy of the estimates depend on whether the lagged dependent variables and explanatory variables are valid instruments in GMM-DIFF estimatio(Garín-Muñoz and Montero-Martín, 2007).

The results with GMM-DIFF coefficients are sensitive in significance to real per capita GDP, relative price to reach Thailand by individuals coming from other countries, nominal exchange rate of other countries to Baht per dollars, and present with expected signs, since a 1% increase in origins' real per capita GDP leads to a 1.959% increase in the total number of tourist arrivals to Thailand, on average an *ceteris paribus* and 1% increase in relative price to reach Thailand by individuals leads to a 0.940% decrease in the total number of tourist arrivals. A 1% increase in the nominal exchange rate of original country to Baht per dollars causes a 0.199 % increase in the total number of tourist arrivals to Thailand, on average and *ceteris paribus*. Finally a 1% increase in the total number of tourist arrivals from the top ten countries to Thailand in the past year leads to a 0.096 % increase in the total number of tourist arrivals to Thailand, on average and *ceteris paribus*.

3.4 Concluding Remarks

The purpose of this paper was to investigate the determinants of international tourism demand to Thailand, static panel data models using fixed effect, random effect estimators were implemented, while dynamic panel data models adopted the generalized method of moments (GMM) estimator (panel GMM procedures) and panel GMM of Arellano and Bond (1991). This paper uses time series data from 1981–2007 for the top ten countries that send the most international tourists to Thailand, which include Malaysia, Japan, Korea, China, Singapore, U.K., U.S.A., Australia, Germany, and Taiwan, to estimate international tourism demand to Thailand. The nature of the short run and long run relationships was examined empirically by estimating a static linear fixed and random effect model and difference transformation dynamic model, respectively. A very important finding was that, both in short run and long run, the coefficients are sensitive in significance to real per capita GDP, nominal exchange rate of original country to Bath per dollars, relative price to reach Thailand by individuals coming from original country and also to transport costs to reach Thailand by individuals coming from original country and present expected signs, especially in all static model. However, some cases in short run dynamic model still be doubted for real per capita GDP with unexpected signs. One of the main conclusions of the study is the significant value of the lagged dependent variable in dynamic panel data for every model (1.105. 0.980, 0.860, 0.096), which may be interpreted as a minor word-of-mouth effect on the consumer decision in favor of the destination. The government, TAT, and the private sector should be monitored more carefully for every condition related to tourism which causes a negative image to tourists during travel in Thailand. The estimated values of

the income elasticity suggest that the economic conditions of tourists who visit Thailand are very important factors in determining tourism demand to Thailand. The estimated values of the income elasticity in panel static model show most of the results tourism to Thailand is a luxury good. Moreover tourism to Thailand is more sensitive to relative prices from original countries than nominal exchange rates of the original country to Baht per dollars and transport costs to reach Thailand by individuals coming from other countries.

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Table 3.4 Descriptive Statistics of Variable in panel data

Variable	Mean	Std. Dev	Min	Max	Observations
LnDT – overall	12.62947	1.01137	9.057888	14.27207	N = 270
- between		5421947	11.93326	13.68774	n = 10
- within		.8702341	9.754101	14.54449	T = 27
LnY – overall	9.26699	1.222155	5.26284	10.6165	N = 270
- between		.236756	6.363287	10.40789	n = 10
- within		.334567	8.166543	10.37369	T = 27
LnTC – overall	-4.630463	.5588851	-5.519437	-2.725351	N = 270
- between		.1174437	-4.769207	-4.358014	n = 10
- within		.5476246	-5.791885	-2.997799	T = 27
lnRP – overall	-.0648708	.1884156	-.5154645	.6980007	N = 270
- between		.1174437	-.203615	.2075776	n = 10
- within		.1517912	-.4155864	.4255523	T = 27
LnER – overall	1.982569	2.103512	-3.53021	4.299622	N = 270
- between		2.187384	-3.401531	3.888777	n = 10
- within		.3202651	1.124757	2.94197	T = 27
Country – overall	5.5	2.877615	1	10	N = 270
- between		3.02765	1	10	n = 10
- within		0	5.5	5.5	T = 27
Year – overall	14	7.803345	1	27	N = 270
- between		0	14	14	n = 10
- within		7.803345	1	27	T = 27

Table 3.5 Results of panel unit root tests based on 4 method tests for all variables

Method test	Test statistic	Significance level for rejection
Null : unit root (assumes common unit root process)		
Levin,Lin and Chu (2002) t*- Statistics		
1. $lnDT_{it}$	1.67	0.95
2. lnY_{it}	-0.39	0.34
3. $lnTC_{it}$	-2.88	0.002
4. $lnRP_{it}$	1.05	0.85
5. $lnER_{it}$	-0.59	0.27
Breitung(2000)t*-Statistics		
1. $lnDT_{it}$	-1.86	0.03
2. lnY_{it}	-0.03	0.48
3. $lnTC_{it}$	-1.18	0.033
4. $lnRP_{it}$	-1.18	0.033
5. $lnER_{it}$	1.19	0.88
Null : unit root (assumes individual unit root process)		
Lm, Pesaran and Shin (2003) W-Statistics		
1. $lnDT_{it}$	1.19	0.88
2. lnY_{it}	-1.39	0.09
3. $lnTC_{it}$	3.25	0.999
4. $lnRP_{it}$	1.18	0.88
5. $lnER_{it}$	-0.13	0.44
Maddala and Wu (1999) and Choi (2001)		
ADF-Fisher Chi-square		
1. $lnDT_{it}$	15.10	0.77
2. lnY_{it}	37.40	0.01
3. $lnTC_{it}$	3.07	0.999
4. $lnRP_{it}$	16.93	0.65
5. $lnER_{it}$	17.34	0.63
PP-Fisher Chi-square		
1. $lnDT_{it}$	27.79	0.35
2. lnY_{it}	9.62	0.97
3. $lnTC_{it}$	1.24	0.99
4. $lnRP_{it}$	13.11	0.87
5. $lnER_{it}$	12.84	0.88

A * indicates the rejection of the null hypothesis of non-stationary (Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), Fisher-Type test using ADF and PP-test (Maddala and Wu (1999) and Choi (2001)) or stationary at least at the 10 percent level of significance.

Table 3.6 Results of panel unit root tests after first differencing into these variables.

Method test	Test statistic	Significance level for rejection
Null : unit root (assumes common unit root process)		
Levin,Lin and Chu (2002) t*- Statistics		
1. $\ln DT_{it}$	8.52*	0.000
2. $\ln Y_{it}$	-7.83*	0.000
3. $\ln TC_{it}$	-12.61*	0.000
4. $\ln RP_{it}$	-9.88*	0.000
5. $\ln ER_{it}$	-5.41*	0.000
Breitung(2000)t*-Statistics		
1. $\ln DT_{it}$	-5.33*	0.000
2. $\ln Y_{it}$	-3.47*	0.000
3. $\ln TC_{it}$	-10.79*	0.000
4. $\ln RP_{it}$	-6.27*	0.000
5. $\ln ER_{it}$	-5.37*	0.000
Null : unit root (assumes individual unit root process)		
Lm, Pesaran and Shin (2003) W-Statistics		
1. $\ln DT_{it}$	-10.35*	0.000
2. $\ln Y_{it}$	-8.09*	0.000
3. $\ln TC_{it}$	-11.56*	0.000
4. $\ln RP_{it}$	-7.93*	0.000
5. $\ln ER_{it}$	-4.34*	0.000
Maddala and Wu (1999) and Choi (2001)		
ADF-Fisher Chi-square		
1. $\ln DT_{it}$	-118.07*	0.000
2. $\ln Y_{it}$	93.56*	0.000
3. $\ln TC_{it}$	725.70*	0.000
4. $\ln RP_{it}$	89.23*	0.000
5. $\ln ER_{it}$	51.57*	0.000
PP-Fisher Chi-square		
1. $\ln DT_{it}$	117.25*	0.000
2. $\ln Y_{it}$	88.64*	0.000
3. $\ln TC_{it}$	725.58*	0.000
4. $\ln RP_{it}$	87.43*	0.000
5. $\ln ER_{it}$	46.00*	0.000

A * indicates the rejection of the null hypothesis of non-stationary (Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), Fisher-Type test using ADF and PP-test (Maddala and Wu (1999) and Choi (2001)) or stationary at least at the 10 percent level of significance.

Table 3.7 Redundant Fixed Effects Tests

Redundant Fixed Effects Tests			
Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	241.349314	(9,256)	0.0000

Table 3.8 Hausman Test

Correlated Random Effects - Hausman Test			
Test period random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	84.573454	4	0.0000

Table 3.9 Period random effects test comparisons

Period random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
LOG(Y)	1.292380	2.131409	0.010935	0.0000
LOG(TC)	-0.120760	-0.040934	0.002252	0.0925
LOG(RP)	-2.241699	-2.090006	0.003242	0.0077
LOG(ER)	0.714638	1.011712	0.003250	0.0000

Figure 3.3 Number of international tourists arrival (DT) to Thailand from 1981 to 2007

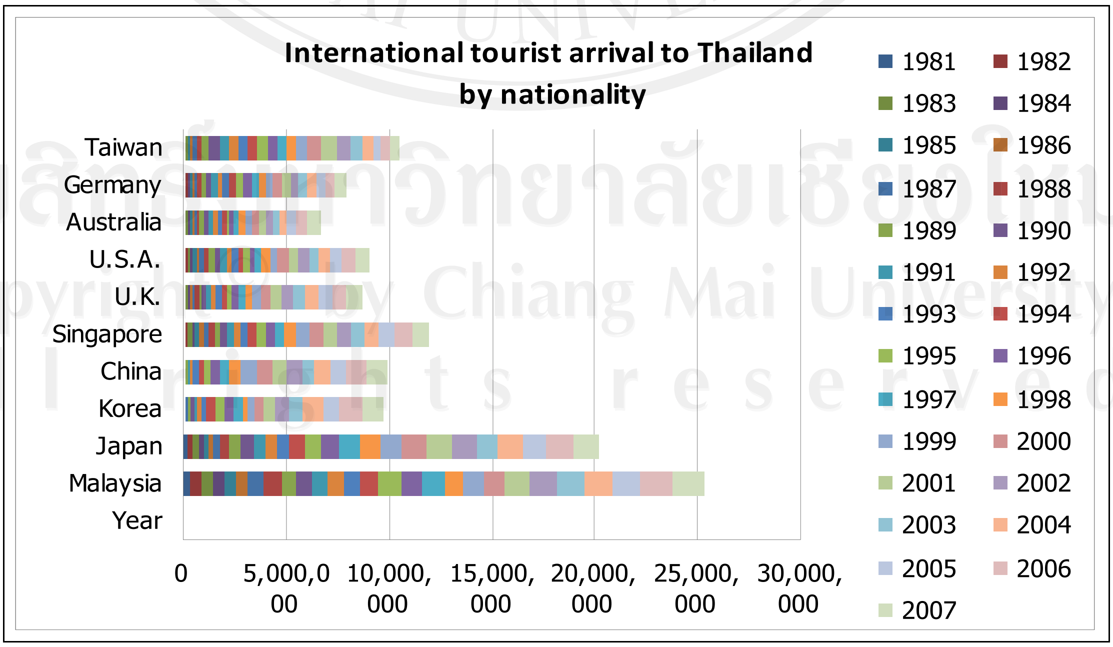


Figure 3.4 Total number of international tourists (DT)

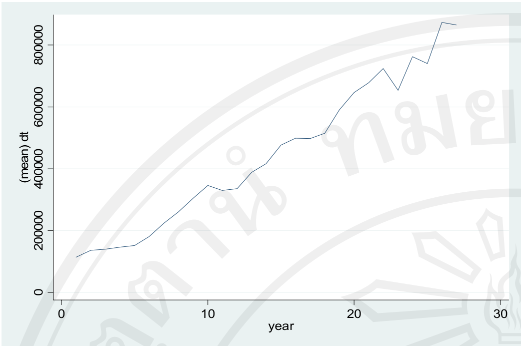


Figure 3.5 Real GDP per capita (Y)

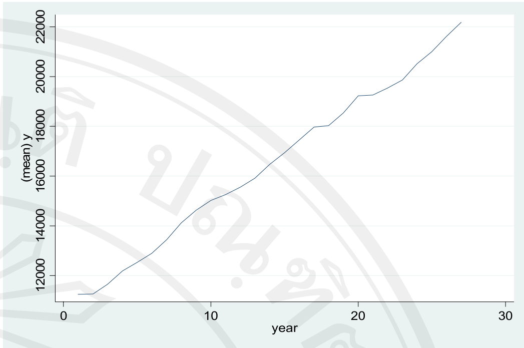


Figure 3.6 Transport costs to reach Thailand (TC)

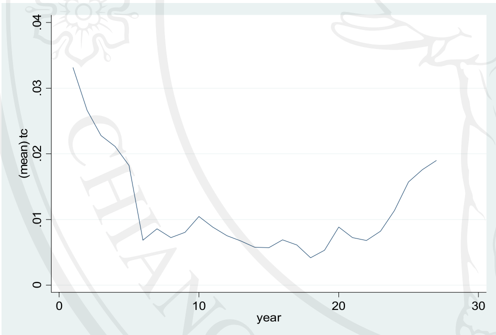


Figure 3.7 Relative price to reach Thailand (RP)

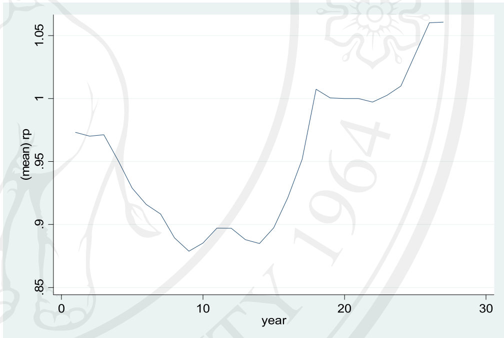


Figure 3.8 Nominal exchange rate of original country to Bath per dollars

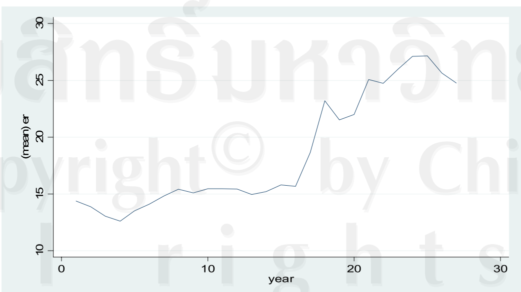


Figure 3.9 international tourists from top ten countries

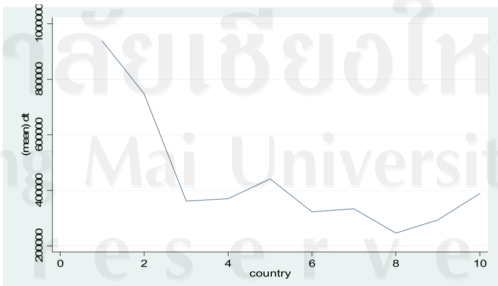


Figure 3.10 Real GDP per capita of top ten countries

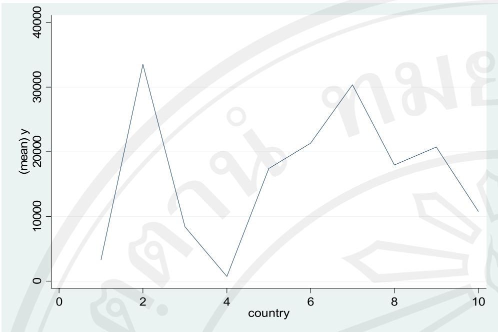


Figure 3.11 Transport costs from top ten countries

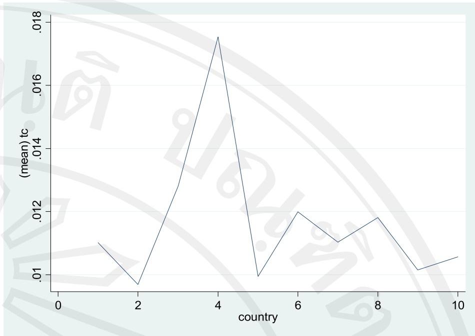


Figure 3.12 Relative price from top ten countries

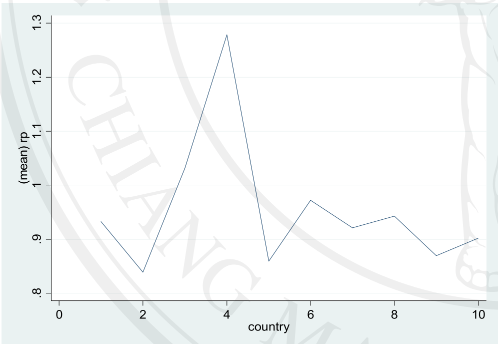
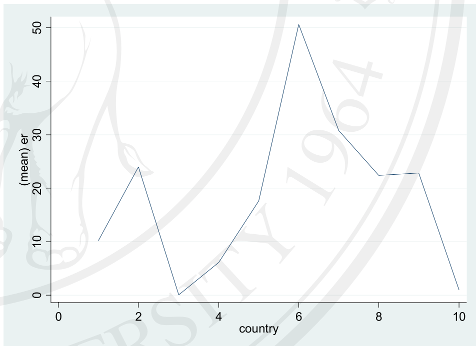
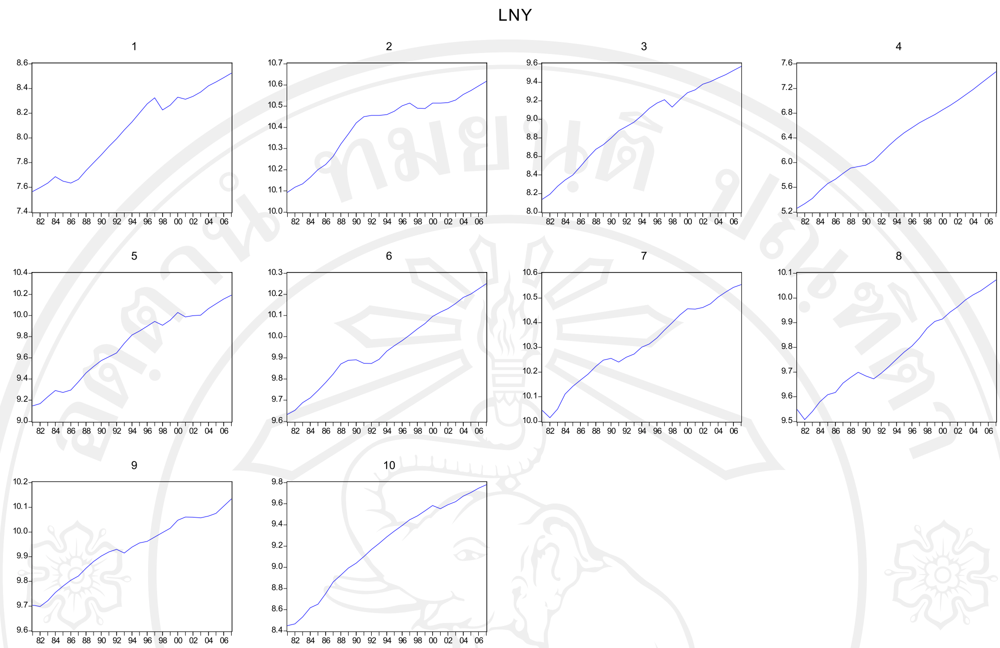


Figure 3.13 Nominal exchange rate from top ten countries



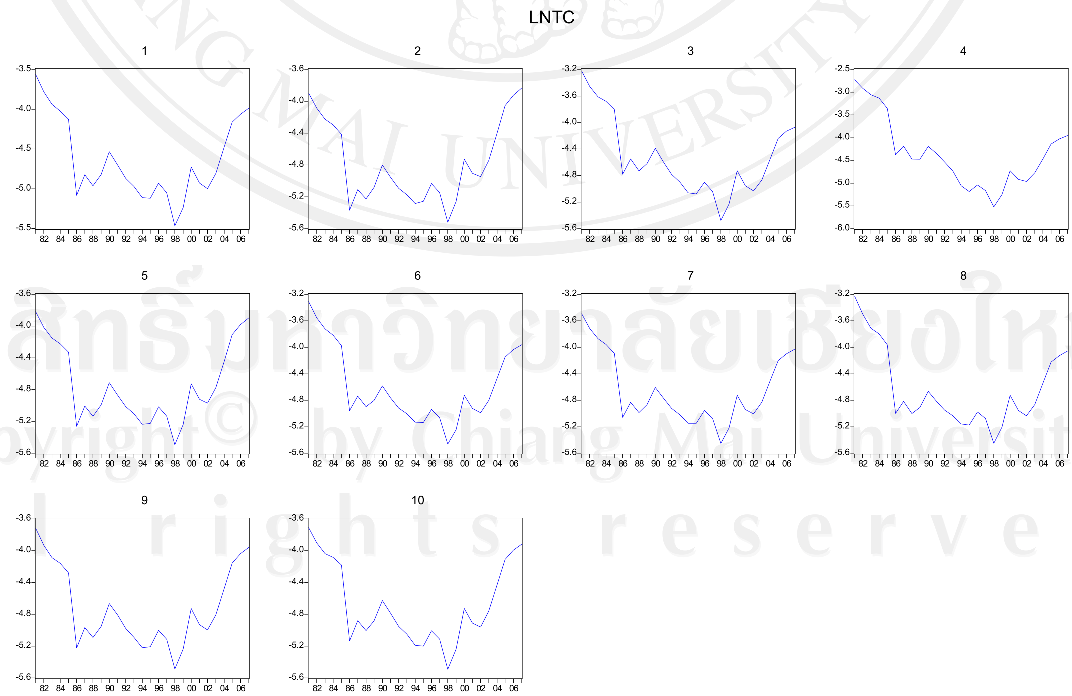
1.Malaysia 2.Japan 3.Korea 4.China 5.Singapore 6.U.K 7 . U.S.A 8. Australia 9. Germany 10. Taiwan

Figure 3.14 LnY of Ten countries



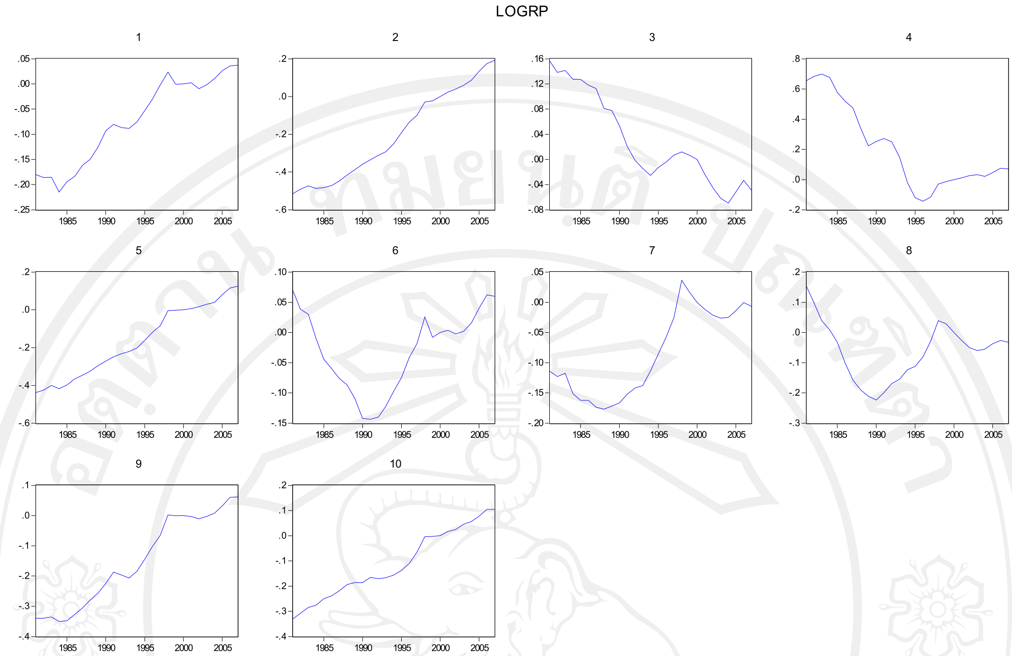
1. Malaysia 2.Japan 3.Korea 4.China 5.Singapore 6.U.K 7 . U.S.A **8.** Australia 9. Germany 10. Taiwan

Figure 3.15 LnTC of Ten countries



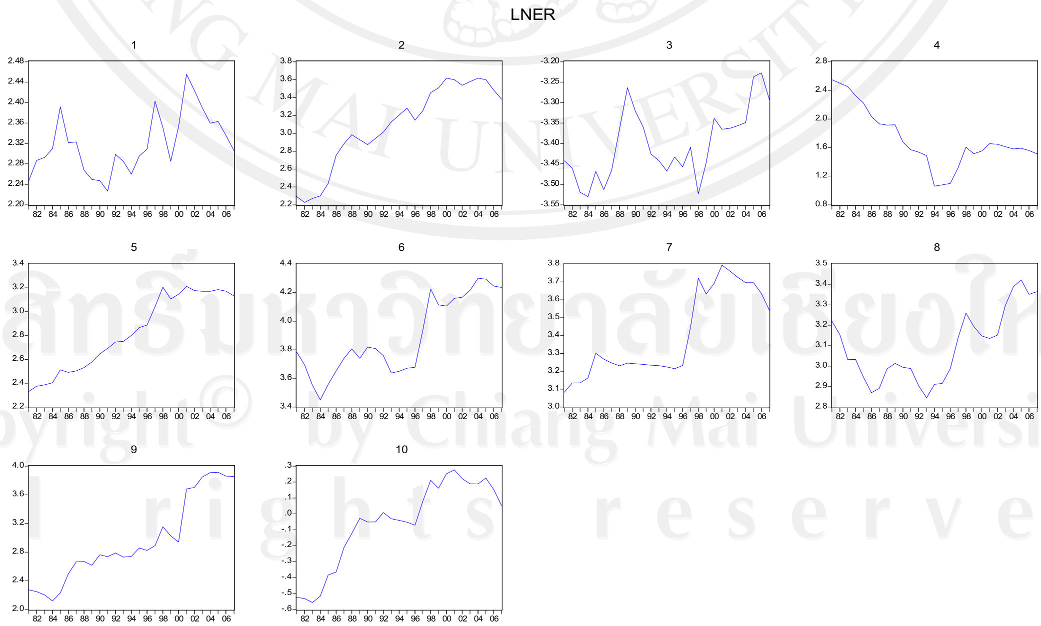
1. Malaysia 2.Japan 3.Korea 4.China 5.Singapore 6.U.K 7 . U.S.A **8.** Australia 9. Germany 10. Taiwan

Figure 3.16 LnRP of Ten countries



1. Malaysia 2.Japan 3.Korea 4.China 5.Singapore 6.U.K 7 . U.S.A **8.** Australia 9. Germany 10. Taiwan

Figure 3.17 LnER of Ten countries



1. Malaysia 2.Japan 3.Korea 4.China 5.Singapore 6.U.K 7 . U.S.A **8.** Australia 9. Germany 10. Taiwan