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Pooled Time-Series Analysis on Traffic Fatalities in Thailand

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The purpose of this paper was to evaluate whether policy, personal and socioeconomic, demographic, and geographic factors influence the fatality rate for motor vehicle accident in Thailand. The findings in this study were based on the pooled time-series analysis for the time period 2006-2009 and covering 76 provinces. The finding in the analysis of fatality-related factors was that education level, number of motorcycles, and VKT of motorcycles found to be the most significantly related components. In terms of policy-related factor, government budget for road safety had negatively influenced the number of fatalities from motor vehicle traffic accidents.

JEL Codes: I12, I18

1. Introduction

According to the report from Central Information Technology Center, Royal Thai Police (2011), motor vehicle traffic accident had claimed 9,205 lives, 21,916 injuries, and approximately 62.2 million Baht in 2011. Due to death and a high cost in economic loss, the public and policymakers have recognized the need for preventing and reducing the severity of motor vehicle accidents.

Over decades, policies related to road safety and regulations have been evaluated by various economists and government agencies. More specifically, these evaluations have taken into account personal and socioeconomic factors such as income, education, fuel consumption, and economic growth. Interconnections exist between policy-related and socioeconomic variables. Sam Peltzman (1975) among the first who evaluated driver response to regulations based on the theory of consumer offsetting behavior. He pointed out that driving with more intensity has resulted in higher probability of death and can be obtained only by forgoing some safety. Therefore, in his study, Peltzman argued that safety regulations might not be as effective as claimed. The arguments in support or against Peltzman's work had followed by number of respect empirical works on evaluating the effects of public policy in preventing traffic fatalities such as French, Gumus, and Homer (2009), Morrisey and Grabowski (2005), Grabowski and Morrisey (2004), Sass and Zimmerman (2000), Fowles and Loeb (1995), Keeler (1994), etc.

In Thailand, the study by Kosalakorn (2001) examined socioeconomic, demographic, and policy related variables on motor vehicle traffic fatalities based on annual data from 1965 to 1996. The study reported that speed-limit law, alcohol consumption, education, and population density found to be significantly influenced the number of motor vehicle traffic fatalities. On the other hand, there were quite number of early studies in Thailand

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on the analysis of economic losses from traffic accidents such as Department of Highways (2007), Suwanrada (2005), Luathep and Tanaboriboon (2005), Boontam (2001), Tosutho (1997), and Patamasiriwat (1994). It is important to notice that all of the previous studies on Thailand traffic accident had done their analyses based on the time-series data at the national level due to limitations of data availability and collection method. No prior study has applied the pooled time series analysis into their models. With recent access to a new data set that is available at the provincial level, this study has taken into account of econometric analysis using panel data from 76 provinces over the 2006 through 2009. A new national model has been developed in the study which believes to be beneficial to the reduction of motor vehicle traffic fatalities. The main purpose of this study was to evaluate the influence of policy-relayed, personal and socioeconomic, demographic, and geographic factors on the fatality rate for motor vehicle accident in Thailand.

The rest of the paper is structured as follow: First, the extant literature on factors affecting motor vehicle traffic accident are reviewed and specifically defined by policy-related, personal and socioeconomic, geographic, and demographic factors. This is followed by the research methodology and data analysis techniques. The findings are then presented and discussed. Finally, the paper concludes with a summary of the research contributions.

2. Literature Review

As mentioned in the previous section, the role of policies related to road safety and regulations along with other social factors has been studied extensively worldwide. The extant econometric methods have also taken into account for an accurate assessment of the impact of related factors on traffic safety. This study, however, has focused only on literature related to traffic accidents in Thailand. The literature, then suffers from limitations of data and relatively few updated studies on Thailand's cases. Much of the existing research on motor vehicle traffic fatalities and accidents is mostly descriptive and published as government reports. Some have done their analysis primarily based on narrow samples from hospital discharge data, traffic crash records, or police records in order to estimate the value of a loss of life or injury from traffic accident.

The following literatures are indentified into 4 specifications or areas involved policy-related, personal and socioeconomic, geographic, and demographic factors:

(1) Policy-related Factors

Enforcement expenditures have always been an important tool for increasing traffic safety. As of 2010, over 3.7 Billion Baht were invested in traffic safety annually by the Thai federal government (Bureau of the Budget, 2012). Despite large budget in highway and traffic safety, traffic fatalities and injuries continue to appear in tragic numbers. The effectiveness of safety investments, therefore, needs to be evaluated. Tosutho (1997) evaluated efficacy of direct and indirect safety budgets spending on reducing traffic accidents.[i] By using aggregate time-series data for the period 1962 to 1996, the study found these budgets to be effective in reducing motor-vehicle traffic fatalities. A study by Kosalakorn (2001) supported Tosutho's finding which found a significant effect of the Thai government budget for road safety in saving lives. In addition, safety-device regulations such as seatbelt and helmet use laws were found in the reduction of motor vehicle traffic accidents in South East Asia including Thailand which was confirmed by the study of Al-Haji and Lindskog in 2005.

(2) Personal and Socioeconomic Factors
A higher standard of living in Thailand has allowed people to improve health and safety, economic growth, incomes (proxied by GDP), and education, enabling them to purchase better nutrition, clothing, shelter, and medical care. A higher standard of living also enables people to purchase safer forms of transportation, including safer automobiles and motorcycles. Moreover, the economic growth has been primarily directed to the development of the road transportation. The study by Japan International Cooperation Agency (1985) indicated that the road networks in Thailand have been expanded and traffic volume has increased sharply throughout the nation resulting from the rapid growth in the 1980s.

Based on the idea that people with higher levels of education are more likely to pay attention to health and safety, Kosalakorn (2001) and Al-Haji and Lindskog (2005) evaluated the influence of education on safe driving in Thailand. As a result, they found a positive relationship between reduction in number of accident and the level of education.

(3) Demographic Factors
Considerable actuarial research has focused on identifying characteristics of drivers involved in traffic accidents. Most studies focused on demographic characteristics of age and gender. Male drivers are more likely to be involved in fatal crashes than are female drivers statistically. Moreover, the number of motor vehicle registrations may vary systematically with the demographic makeup of driving population. The studies by Kosalakorn in 2001 and Suntikarn and Dumnakaew in 1994 confirmed positive relationship between the number of motor vehicle registrations and traffic accidents.

(4) Geographic Factors
In area of high density (urban), there is less need for lengthy travel so drivers make more frequent stops. Therefore, all other things being equal, fatal accidents are lower than in a low-density area (Keeler, 1994). In addition, traffic congestion in a high-density area tends to prevent high speed. The low absolute level of speed, in high-density area, reduces a chance of people being killed when an accident occurs. The low absolute level, in high-density area, reduces a chance of people being killed when an accident occurs. Supporting this hypothesis is the study by Kosalakorn (2001) and Houston, Richardson, and Neeley (1995) which found population density to be negatively and significantly related to traffic fatalities.

Based on this review of existing studies related to Thailand, the analysis of this paper is the first to apply the pooled time series analysis to a new dataset on traffic fatalities, traffic policies, and other control variables. With an estimation technique applied here the study would contribute and explore new insight into relationships between these related factors and motor vehicle traffic fatality rate.

3. Methodology

The data used in this study consisted of a panel of 304 observations. Due to the data availability, regional database from the year 2006 to 2009 were collected with annual data from 2006 to 2009 for all 76 provinces in Thailand. All 76 provinces had been characterized into 5 regions – the central region, the northern region, the northeastern region, the eastern region, the western region, and the southern region.

With the panel data model, it is beneficial to incorporate the regional effect of the independent variables with the traffic fatality rate. The main advantage was the detection of fixed, respectively stochastic effects, which were be able to diagnose only cross-application data. In addition, a problem of lacking number of observations with Thailand database will be solved.

As Hicks (1994) noted, in pooled time series, errors for regressions equations estimated from pooled data using ordinary least squares regression procedures tend to be (1) temporally autoregressive, (2) cross-sectionally heteroscedastic, and (3) cross-sectionally correlated as well as (4) conceal unit and period effects and (5) reflect some causal heterogeneity across space, time, or both". To deal with causal heterogeneity across space, often fixed cross-sectional effects are assumed. Formally, the fixed effects model is given by:

$$y_{it} = x_{it}\beta + v_i + \varepsilon_{it}$$

where v_i are assumed to be fixed parameters which may be correlated with x_{it} . Such a model focuses on the within-country variation, and the coefficients represent a cross-country average of the longitudinal effect.

If the unobserved cross section- or time-specific heterogeneity is realizations of a random process and uncorrelated with the included variables, then the model is a random effects model. Thus, the crucial distinction between the fixed and the random effects model is whether the unobserved cross section - and time-specific effect embodies elements that are correlated with the regressors in the model (Greene 2003). If there is no significant correlation between the unobserved cross section-specific random effects and the regressors, then the random effects model may be more powerful and parsimonious. If there is correlation between the unobserved cross section-specific effects and the regressors, the random effects model would be inconsistently estimated and the fixed effects model would be the model of choice. The advantages of fixed effects (FE) specification are that it can allow the individual and/or time specific effects to be correlated with explanatory variables X_{it}. Neither does it require an investigator to model their correlation patterns. The disadvantages of the FE specification are: (a) The number of unknown parameters increases with the number of sample observations. In the case when T (or N) is finite, it introduces the classical incidental parameter problem (e.g. Neyman and Scott (1948)). (b) The FE estimator does not allow the estimation of the coefficients that are time-invariant. The advantages of random effects (RE) specification are: (a) The number of parameters stay constant when sample size increases. (b) It allows the derivation of efficient estimators that make use of both within and between (group) variations. (c) It allows the estimation of the impact of time-invariant variables.

To choose between the two specifications, the Breusch-Pagan Lagrange multipliers test and the Hausman specification test helped us on the selection of the appropriate model (i.e. pooled vs. individual effects, and fixed vs. random effects). For example, the null hypothesis of Hausman test is: H_0: $E(\eta_i \mid X_{it}) = 0$ which mean that the null hypothesis will be accepted or there is no correlation between regressors and effects, then FE and RE are both consistent, but FE is inefficient. On the other hands, if there is correlation, FE is consistent and RE is inconsistent.

However, the data used in this study have 76 provinces which are group into 5 regions for cross section and it is annual data only for three years. Therefore, our study has limitation that we can use only fixed effects estimation. Even our study has limitation in database, this study still have some advantage that it incorporate the regional effect on fatality rate, economic factors and policy-related factors while many study in Thailand observe only demographic and geographic factors and study in national level.

Follow by Kosalakorn (2001), the independent variables in our model comprise of four groups: 1) policy-related variables, 2) personal and socioeconomic variables, 3) demographic characteristics, and 4) geographic factors:

Fatality rate = f (Policy, Economic, Demographic, Geographic)

Number of hospital and government budget for traffic accident are use as policy-related variables. Personal and socioeconomic variables include amount of fuel consumption per capita, number of injured people caused by traffic accident, real income per capita in each provinces, level of education of people in each provinces, and unemployment rate. Demographic characteristics comprise of distance of driving (VKT), number of vehicles (which divide into bus, personal car, truck, motor cycle, and other types of vehicle), and population divide by sex and age group. Moreover, the population was characterized into 4-age groups for both male and female. These groups comprised of 1) population of age 15-29, 2) population of age 30-59, and 3) population of age more than 60. Geographic factors included population density and dummy variables for cross section specific effect (five regions). All variables except dummy variables are used in log form. The model of Thailand traffic fatalities to be tested is specified as followed:

$$\begin{aligned}\ln(FATAL_{it}) = {} & b_{0i} + v_i + b_1 \ln(GACC_{it}) + b_2\ln(HOSP_{it}) + b_3 \ln(FUEL_{it}) \\ & + b_4\ln(INJ_{it}) + b_5\ln(RGPPCAP_{it}) + b_6\ln(EDU_{it}) \\ & + b_7\ln(UMP_{it}) + b_8\ln(VKT_{it}) + b_9\ln(VKTMC_{it}) \\ & + b_{10}\ln(BUS_{it}) + b_{11}\ln(CAR_{it}) + b_{12}\ln(TRC_{it}) \\ & + b_{13}\ln(OTH_{it}) + b_{14}\ln(MC_{it}) + b_{15}\ \ln(VH_{it}) \times \ln(VKT_{it}) \\ & + b_{16}\ln(MC_{it}) \times \ln(VKTMC_{it}) + b_{17}\ln(PM15T29_{it}) \\ & + b_{18}\ln(PM30T59_{it}) + b_{19}\ln(PM60UP_{it}) + b_{20}\ln(PD_{it}) + u_{it}\end{aligned}$$

Table 1A: Variable Definitions in the Traffic Fatality Model

Variable	Definition	Unit	Sources	Expected Sign
Dependent Variable				
FATAL	All vehicle traffic fatalities	Person	Royal Thai Police	
Policy-related variables				
GACC	Government budget for traffic accident	Million Baht	Department of land transport	-
HOSP	Number of hospitals	Unit	Ministry of Public Health	-
Personal and socioeconomic variables				
FUEL	Selling amount per capita: All Fuel	1000 liters/person	"--------------------------"	+
INJ	Number of injured people by traffic accident	Person	Royal Thai Police	+
RGPPCAP	Real Gross provincial product per capita	Baht per person	Bank of Thailand	+/-
EDU	Percent of people graduated upper secondary to population	%	Ministry of Education, Author's calculation	-
UMP	Unemployment rate (provincial data)	%	Bank of Thailand, Author's calculation	+
Demographic characteristics				
VKT	Vehicle kilometer travel (except motorcycle)	Kilometer	Department of Highway	+
VKTMC	Motorcycle kilometer travel	Kilometer	"-------------------------"	+
BUS	# of registered Bus	Unit	Department of land transport	+
CAR	# of registered Car	Unit	"--------------------------"	+
TRC	# of registered Truck	Unit	"--------------------------"	+
OTH	# of registered other vehicles	Unit	"--------------------------"	+

Table 1B: Variable Definitions in the Traffic Fatality Model

Variable	Definition	Unit	Sources	Expected Sign
Demographic characteristics				
VH	# of registered vehicles (except motorcycle)	Unit	"--------------------------"	+
MC	# of registered motorcycle	Unit	"--------------------------"	+
VH*VKT	Interaction term between Number of vehicle and VKT	Unit x Kilometer	Author's calculation	+
MC*VKTMC	Interaction term between number of motor cycle and its VKT	Unit x Kilometer	"--------------------------"	+
PM15T29	Male age 15-29	1000 persons	Ministry of Public Health	+
PM30T59	Male age 30-59	1000 persons	"--------------------------"	+
PM60UP	Male age more than 60	1000 persons	"--------------------------"	-
PF15T29	Female age 15-29	1000 persons	"--------------------------"	+
PF30T59	Female age 30-59	1000 persons	"--------------------------"	+
PF60UP	Female age more than 60	1000 persons	"--------------------------"	-
Geographic factors				
PD	Population density	Index	Department of provincial administration	-

4. The Findings

The estimation results for the model are presented in Table 2. The estimated coefficients together with the t-statistic were reported in the last two columns. The overall control variables for policy-related, personal and socioeconomic, demographic, and geographic factors were found to be statistically significant and mostly impacted on motor vehicle traffic fatality rate in the expected direction. All these specifications related to motor vehicle traffic fatalities were discussed as the following:

Policy-related variables

As primary concern, the government budget for road safety was statistically significant and performed in expected direction. The meaningful results from the government's expenditure on road safety—negatively correlated with traffic fatalities—might suggest that an increase in the government effort had a persistent effect on traffic fatality rate. Surprisingly, number of hospitals had a positive and statistically insignificant influence on the traffic fatality rate. This insignificant result showed virtually no impact on the reduction of Thailand traffic fatality rate.

Personal and socioeconomic variables

By considering the personal and socioeconomic structure of each province, there were both significant and insignificant results associated with traffic fatalities. Level of education had a negative and statistically significant influence on traffic fatality rate; the higher level of education the lower number of traffic fatality rate. In addition, the coefficients for education are consistent with a hypothesis that a higher level of education is directly related to a higher level of health concern.

The coefficient estimate of unemployment at the provincial level found to have a significant increase in traffic fatality rate. The finding suggested that this personal and socioeconomic stress might reflect on driving behavior which might cause an accident involving traffic fatalities.

Moreover, the coefficient associated with GPP as a proxy of income was positive and statistically significant. With an upward time trend between income and traffic fatalities, the result can be explained in two directions. First, as income increases, the desire for a safer automobile does not. On the other hand, it may be possible that drivers are more dangerous in safer automobiles due to the result that supported Peltzman's offsetting effect which higher income meant higher risk.

Lastly, the relationship between traffic fatality rate and volumes of fuel consumption had an opposite sign with statistically insignificant. Contrast to an assumption of an increase in fuel consumption that would result in higher traffic fatality rate due to an increase in demand for driving.

Demographic characteristics

Importantly, as proxies for motor vehicle usage, the Vehicle Kilometers Traveled (VKT) variables were highly related to traffic fatalities, especially for the VKT of motorcycle. As a dominant mode of transport in Thailand, motorcycle usage or its VKT had the highest positive impact on the traffic fatality rate and at a significant level. The number of registered vehicles also had a positive and significant relationship with the traffic fatality rate for all types of vehicles. However, the relationship between fatality rate and the interaction effect between number of registered vehicles and its VKT was negative and significant for all types of vehicles.

For population structure, the relationship between fatality rate and population by age group were all significant for both male and female in all age groups. Changing in number of population age 30-59 would affect rate of fatality than other groups for both male and female. However, the relationships were positive for all groups of male population but negative for all groups of female population. The result of men in all age group carried a significantly positive coefficient indicating a possibility of reckless driving taking a fall comparing to women.

Geographic characteristics

In order to find the difference of geographic characteristics among regions, dummy variables were used as the proxy for five regions including the northern, the northeastern, the eastern, the western, and the southern regions. The significant of dummy variable of each region indicated that a region had different level of fatality rate than central region. The result showed that most regions except the northeastern region have significant lower traffic fatality rate than the central region.

With the surprising result of demographic factor, in terms of rural versus urban fatal crashes, the study found population density to be positively and significantly related to traffic fatalities. It pointed out the higher traffic fatalities in a high-density area (urban) than in a low-density area.

Table 2: Estimated Model of Motor Vehicle Traffic Fatality Rates, 2006-2009

Variable	Coefficient	t-Statistic
Constant	31.62	1.86
Policy-related variables		
Government budget for road safety	-0.01	-3.19**
No. of hospital	2.03	1.66
Personal and socioeconomic variables		
FUEL Consumption	-0.03	-1.05
No. of injured people	0.11	5.64**
Real GPP per capita	0.02	1.8
Education level	-6.85	-3.22**
Unemployment rate	0.22	5.39**
Demographic characteristics		
VKT of Vehicle	0.62	16.21**
VKT of Motor cycle	1.52	12.23**
No. of Bus	0.14	4.66**
No. of Personal Car	0.72	22.94**
No. of Truck	0.2	5.72**
No. of Other vehicles	0.08	9.05**
Total vehicle * VKT	-0.04	-10.02**
Motor cycle * VKT	-0.11	-10.65**
Male (age 15-29)	0.33	1.96**
Male (age 30-59)	1.67	3.95**
Male (age over 60)	0.82	6.62**
Female (age 15-29)	-0.79	-3.31**
Female (age 30-59)	-1.42	-3.82**
Female (age over 60)	-0.53	-3.75**
Geographic characteristics		
Population density	0.02	3.13**
Fixed effects		
Central	0.14	10.32**
North	-0.15	-6.71**
Northeast	0.04	1.48
East	-0.18	-4.00**
West	-0.06	-2.67**
South	-0.13	-10.41**
N = 304	**R-squared** = 0.9591	
Durbin-Watson stat = 1.4766		

5. Summary and Conclusions

This paper, using pooled time-series model for fatality rates in Thailand for the time period 2006-2009, evaluated the efficacy of mainly four groups of variables: policy-related, personal and socioeconomic, demographic, and geographic variables. The study has confirmed the validity and reliability of the current provincial data set for studying the influence of involved determinants on motor vehicle traffic fatalities. The findings indicated the mixing results for the policy-related variables in which government budget for road safety was significant in the reduction of motor vehicle traffic fatalities. Number of hospitals, on the other hand, showed insignificant impact on motor vehicle traffic fatalities.

However, the result is noteworthy when one considers that the policy-related variables were incorporated in the model with a large number of other important control variables which also have strong impacts on motor vehicle traffic fatalities. In this study, education level, number of motorcycles, and VKT of motorcycles also found to be the most significantly related components that influenced traffic fatalities. Population density, on the other hand, showed the differences between urban and rural areas which the higher possibility of traffic fatalities occurred in a high density area than in a low density area for Thailand.

In conclusion, a substantial reduction in motor vehicle traffic fatalities in Thailand resulting from policy-related variables does not necessarily imply an effectiveness of such policy economically. Value of social losses and gains then must be evaluated promptly with regard to traffic fatalities.

Endnotes

[i] Direct Budgets for road safety include monitoring of motor vehicles and road users on the roads, land transportation schools, land transportation examination, automobiles condition checking, vehicles registration and driver license holders, the construction roadway countermeasure (lighting, roadway barriers), the correction of hazardous road section, road safety education programs, and audit of road safety.
Indirect budgets for road safety include the construction of roads and bridges, the maintenance of roads and bridges, and the adjustment of roads and bridges.

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Appendix

Table Appendix 1: Estimated result

Dependent Variable: LOG(FATAL_?)
Method: Pooled EGLS (Cross-section weights)
Sample (adjusted): 2007 2009
Included observations: 3 after adjustments
Cross-sections included: 73
Total pool (balanced) observations: 219
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)
Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	31.61719	17.03111	1.856437	0.0649
DC_?	0.143672	0.013916	10.32421	0.0000
DN_?	-0.154939	0.023088	-6.710872	0.0000
DNE_?	0.044750	0.030246	1.479542	0.1407
DE_?	-0.175314	0.043815	-4.001248	0.0001
DW_?	-0.060915	0.022812	-2.670304	0.0082
DS_?	-0.126780	0.012180	-10.40853	0.0000
LOG(VECH_?)	0.616808	0.038056	16.20792	0.0000
LOG(VECHMC_?)	1.517247	0.124036	12.23227	0.0000
LOG(BUS_?)	0.141174	0.030305	4.658361	0.0000
LOG(CAR_?)	0.720655	0.031412	22.94192	0.0000
LOG(TRC_?)	0.197811	0.034577	5.720908	0.0000
LOG(OTH_?)	0.078949	0.008720	9.054284	0.0000
LOG(MC_?)	2.286648	0.210071	10.88513	0.0000
LOG(NMC_?)*LOG(VECH_?)	-0.041498	0.004143	-10.01713	0.0000
LOG(MC_?)*LOG(VECHMC_?)	-0.109633	0.010296	-10.64779	0.0000
LOG(TFUEL_?)	-0.026916	0.025531	-1.054239	0.2931
LOG(INJ_?)	0.108262	0.019195	5.639989	0.0000
LOG(RYCAP_?)	0.016913	0.009418	1.795786	0.0741
LOG(MALE1_?)	0.333761	0.170359	1.959166	0.0516
LOG(MALE2_?)	1.666141	0.422186	3.946457	0.0001
LOG(MALE3_?)	0.817612	0.123564	6.616890	0.0000
LOG(FM1_?)	-0.787554	0.238223	-3.305956	0.0011
LOG(FM2_?)	-1.424055	0.372797	-3.819924	0.0002
LOG(FM3_?)	-0.533834	0.142394	-3.748994	0.0002
LOG(ACCBG_?)	-0.014171	0.004436	-3.194200	0.0016
LOG(EDU_?)	-6.854276	2.130213	-3.217647	0.0015
LOG(HOSP_?)	2.027457	1.222743	1.658121	0.0989
LOG(UMP_?)	0.219041	0.040668	5.386129	0.0000
LOG(PD_?)	0.023512	0.007507	3.132209	0.0020

R-squared	0.959026	Mean dependent var	7.765060
Adjusted R-squared	0.952987	S.D. dependent var	5.286478
S.E. of regression	0.214775	Sum squared resid	8.764410
F-statistic	158.8236	Durbin-Watson stat	1.476657
Prob(F-statistic)	0.000000		

Table Appendix 2: Unit root test of residual term

Null Hypothesis: Unit root (individual unit root process)
Series: RESIDAMNATCHAROEN, RESIDANGTHONG, RESIDAYUTHAYA, RESIDBANGKOK, RESIDBURIRUM, RESIDCHACHOENGSAO, RESIDCHAINAT, RESIDCHAIYAPHUM, RESIDCHANTHABURI, RESIDCHIANGMAI, RESIDCHIANGRAI, RESIDCHONBURI, RESIDCHUMPHON, RESIDKALASIN, RESIDKAMPHAENGPHET, RESIDKHANCHANABURI, RESIDKHONKAEN, RESIDKRABI, RESIDLAMPANG, RESIDLAMPHUN, RESIDLOEI, RESIDLOPBURI, RESIDMAEHONGSON, RESIDMAHASARAKHAM, RESIDMUKDAHAN, RESIDNAKHONNAYOK, RESIDNAKHONPATHOM, RESIDNAKHONPHANOM, RESIDNAKHONRATCHASIMA, RESIDNAKHONSAWAN, RESIDNAKHONSITHAMMARAT, RESIDNAN, RESIDNARATHIWAT, RESIDNONGBUALAMPHU, RESIDNONGKHAI, RESIDNONTHABURI, RESIDPANGNGA, RESIDPATHUMTHANI, RESIDPATTANI, RESIDPETCHABURI, RESIDPHATTHALUNG, RESIDPHAYAO, RESIDPHETCHABUN, RESIDPHICHIT, RESIDPHITSANULOK, RESIDPHRAE, RESIDPHUKET, RESIDPRACHINBURI, RESIDPRACHUAPKIRIKHAN, RESIDRANONG, RESIDRATCHABURI, RESIDRAYONG, RESIDROIET, RESIDSAKONNAKHON, RESIDSAMUTPRAKARN, RESIDSAMUTSAKORN, RESIDSAMUTSONGKRAM, RESIDSARABURI, RESIDSATUN, RESIDSISAKET, RESIDSINGBURI, RESIDSONGKHLA, RESIDSRAKAEW, RESIDSUKHOTHAI, RESIDSUPHANBURI, RESIDSURATTHANI, RESIDSURIN, RESIDTAK, RESIDTRAD, RESIDTRANG, RESIDUBONRATCHATHANI, RESIDUDONTHANI, RESIDUTHAITHANI
Date: 10/24/12 Time: 00:55
Sample: 2007 2009
Exogenous variables: None
Automatic selection of maximum lags
Automatic selection of lags based on SIC: 0
Total (balanced) observations: 146
Cross-sections included: 73

Method	Statistic	Prob.**
ADF - Fisher Chi-square	396.542	0.0000
ADF - Choi Z-stat	-9.98063	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.