transport infrastructure; economic growth; spillover effects

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STIMULATE ECONOMIC GROWTH BY IMPROVING TRANSPORT INFRASTRUCTURE – A LESSON FROM CHINA

Summary. This paper uses Feder model to test impacts of transport infrastructure on economic growth. With China provincial data from 1990-2010 the empirical models, including Basic model, Time-Lag model and Spatial model, demonstrate that transport infrastructure does have a positive Spillover Effect on economic growth. However, Direct Effect on economic growth is negative possibly due to Crowding-Out Effect and productivity difference between sectors. The research also proves the Spillover Effects are becoming weaker as time passed. Finally, Spatial Spillover Effect or Network Effects are confirmed.

STIMULIERTES WIRTSCHAFTLICHES WACHSTUM DURCH VERBESSERUNG DER TRANSPORTINFRASTRUKUTR - EIN LEKTOR AUS CHINA

Zusammenfassung. Diese Thesis benutzt Feder-Model, um die Auswirkung der Transportinfrastruktur, die auf das wirtschaftliche Wachstum zu untersuchen. Mit den Daten aus chinesischen Provinzen zwischen 1990 und 2010 durch das empirische Modell, in dem das Basic-Model, Time-Lag-Model und Spatial-Model beinhaltet, kann man dadurch demonstrieren, dass die Transportinfrastruktur eine positive Spillover-Effekt auf das wirtschaftliche Wachstum auswirkt. Direkte Effekt auf das wirtschaftliche Wachstum ist jedoch möglich negativ, durch die Crowding-Out Effekt und Unausgeglichenheit der Produktivität zwischen Sektoren. Diese Studie beweist auch, dass die Spillover-Effekte mit vergangener Zeit schwächt wird. Außerdem werden die Spatial-Spillover-Effekt oder Network-Effekt nachgewiesen.

1. INTRODUCTION

China's economic booming has been researchers' interest for the last few decades. Except institutional reform, many researches attribute it to forward investment in transport infrastructure and considered improved transport infrastructure as the key driver for the achievement. When financial crisis hit Asia in 1998, Chinese government responded with a series of policies boosting domestic demand. Among them, investments in transport infrastructure played an important role. Ten years later, again, Chinese government announced Stimulus Package to counter global economic crisis. 1.5 out of 4 trillion RMB (about US$ 220 billion) was spent on transport related projects, which sparked new wave of construction on transport infrastructure. However, critiques on such policies have never stopped. It is argued that many investments are more like vanity projects which are not economically reasonable. Thus, the need to understand the mechanism of impact of transport investment on economic growth is of more realistic and policy significance.

The view that infrastructure is impetus to economic growth has been widely accepted. In theory, improved transport infrastructure would exert Direct Effects and Indirect Effects on economic development. On one hand, constructed projects need to procure materials and services, which is part of market demand. On the other hand, transport industry is the pillar of any economy. With better transport infrastructure, passengers may enjoy enhanced travel conditions; all the other industries may take advantage of better trade terms, lower transaction costs, higher operational efficiency and productivity. All these externalities are defined as Indirect Effects or Spillover Effects. Furthermore, upgraded transport network would inevitably enhance communications and trade among regions so that encourage specialization and economy of scale. The region, then, enjoy Location Advantages or Spatial Spillover Effects. Sometimes, strong Spatial Effects may influence firms' location strategy resulting in another round of geographic re-distribution.

Empirical researchers have long to find out those effects. Aschauer (1989), Munnell (1990), Canning & Fay (1993), Liu (2010) estimate the elasticity of infrastructure investment on economy. Romer (1986), Liu & Hu (2010), Liu (2010) measured effects of infrastructure on Total Factor Productivity (TFP) and pointed out that improved infrastructure has significantly positive effects on economic growth. But the studies either mix up different effects or fail to specify transport infrastructures.

This paper uses China's provisional data to test effects of transport investment on economic growth. With Feder Model (1983) first it separated Direct Effects from Indirect Effects; then, it set up Time-Lag model and Spatial Model to find out temporal effect and network effect.

2. METHODOLOGY AND DATA

2.1. Feder Model

Feder Model (1983) has been used to explore the role of exports to economic growth. Later on, researches on FDI, industrial development also used the model.

Suppose there are two sectors in the economy, which is transport sector and non-transport sector. Define T and N as the output of transport sector and non-transport sector, L and K as input factor of labor and capital. Production function would be as follows:

$$T = T(Lt, Kt) \tag{1}$$

$$N = N(Ln, Kn, T) \tag{2}$$

Eq. (2) assumes transport sector has externality effect or Spillover Effect on non-transport sector. Eqs. (3)-(5) describe the relationship among labor (L), capital (K) and total production (Y):

$$L = Lt + Ln \tag{3}$$

$$K = Kt + Kn \tag{4}$$

$$Y = T + N \tag{5}$$

Assume marginal productivity of labor and capital between the two sectors are different. Let δ stand for marginal productivity differential. When $\delta = 0 (> 0, < 0)$, marginal productivity of transport sector equals to (larger than or smaller than) non-transport sector. Then, Eq. (6) would be derived as below:

$$\frac{dY}{Y} = \alpha \frac{dK}{Y} + \beta \frac{dL}{L} + \gamma \frac{dT}{T} \frac{T}{Y} \tag{6}$$

where α is marginal productivity of capital in non-transport sector; β represents the productivity elasticity of labor in non-transport sector; dY/Y, dL/L and dT/T indicate the growth rates of total productivity, labor productivity and productivity of transport sector; T/Y is the ratio of transport productivity to total productivity, or the share of transport output; dK/Y denotes incremental capital-output ratio.

In Eq. (6), $\gamma = \delta/(1+\delta) + N_T$ describes the total influences of transport on economic growth. Specifically, γ indicates two different effects of transport sector: first, Direct Effect, as investments promote economic growth and affected by relative marginal productivity between sectors; second, Spillover Effect, which comes from externality of improved transport infrastructure. To measure Spillover Effect, assume non-transport sector affects transport sector with constant productivity elasticity, that is

$$\theta = \frac{\partial N/\partial T}{N/T} = \frac{N_T}{N/T} \tag{7}$$

where θ is the productivity elasticity coefficient, or Spillover Effect coefficient. Substitute Eq. (6) into Eq. (7), then,

$$\frac{dY}{Y} = \alpha\frac{dK}{Y} + \beta\frac{dL}{L} + (\frac{\delta}{1+\delta} - \theta)\frac{dT}{T}\frac{T}{Y} + \theta\frac{dT}{T} \tag{8}$$

Eq. (8) is the Basic Model of this research, with Spillover Effect coefficient θ, and Direct Effect $(\frac{\delta}{1+\delta} - \theta)$.

2.2. Empirical Models

The Basic Model assumes there are two sectors in the economy. Output of transport sector is a function of labor and capital engaged while output of non-transport sector is determined by labor, capital input as well as Spillover Effect of transport sector.

To test the effects, ***Basic Empirical Model*** would be as follows:

$$g_{it} = \beta_0 + \beta_1 ky_{it} + \beta_2 gl_{it} + \beta_3(gt_{it} \times ty_{it}) + \beta_4 gt_{it} + f_i + \varepsilon_{it} \tag{9}$$

where, i represents provinces or administrative regions of provincial level in China; t denotes year observed; g is annual growth rate of GDP; ky and ty denote the ratio of fixed assets investment to GDP and transport infrastructure investment to GDP; gl and gt indicate annual growth rate of labor input and transport infrastructure investment; f_i (fixed factor) controls location factors. In addition, transport infrastructure investment is used to denote productivity of the transport infrastructure sector.

The Basic Empirical Model uses data of same period to test Spillover Effect, that is to say overlooking time dimension. However, transport infrastructures serve in a long term. If Time Effect is taken into account, ***Time Lag Model*** would be a better choice, which is Eq (10).

$$g_{it} = \beta_0 + \beta_1 ky_{it} + \beta_2 gl_{it} + \beta_3(gt_{it-n} \times ty_{it-n}) + \beta_4 gt_{it-n} + f_i + \varepsilon_{it} \tag{10}$$

Generally, transport infrastructure lasts for years, so the lag time is indexed, n=1, 2, 3, 4, 5.

Transport service usually works in a network. As a result, transport infrastructure would influence both local markets and cross-regional communications and transactions. Therefore, this research introduces two spatial models: ***Spatial Error Model (SEM)*** **and** ***Spatial Lag Model (SLM)*** to estimate Spatial Effect of transport infrastructure.

SEM model specified as:

$$g_{it} = \beta_0 + \beta_1 ky_{it} + \beta_2 gl_{it} + \beta_3(gt_{it} \times ty_{it}) + \beta_4 gt_{it} + \varepsilon_{it} \tag{11}$$

$$\varepsilon_{it} = \lambda W \varepsilon_{it} + \mu_{it}$$

$$\varepsilon_{it}, \mu_{it} \sim N(0, \sigma^2 I)$$

SLM model is presented below:

$$g_{it} = \beta_0 + \beta_1 ky_{it} + \beta_2 gl_{it} + \beta_3 (gt_{it} \times ty_{it}) + \beta_4 gt_{it} + \rho W g_{it} + \varepsilon_{it} \quad (12)$$

where, ε_{it} and μ_{it} is random errors which is of normal distribution; ρ , λ are spatial lag coefficient and spatial error coefficient, respectively; W is standardized spatial weights matrix generated based on spatial neighbouring attributes. The element is '1' for neighbouring regions or '0' if not. In the Spatial Lag Model, the spatial dependence among regions leads to spatial autocorrelation. In the Spatial Error Model, the spatial influence comes only through the error terms (Anselin, 1988). Considering spatially lagged dependent variable and spatial lagged error in Eq. (11) and Eq. (12), this research applied Maximum Likelihood Estimation (MLE) method (Elhorst, 2003) to estimate efficiencies.

In a word, this research developed three models to test effects of transport infrastructure on the economic growth, that is, Basic Empirical Model, Time Lag Model and Spatial Model.

2.3. Source of Data

This research used panel data of China's provincial level from 1990-2010 to test the effects. GDP and fixed investment are evaluated at current market price; total number of people employed signifies labor quantity; total investment of fixed assets in Transportation & Warehousing & Post Service Industry (at current market price) is used as measurement of transport infrastructure investment. All the statistic data are collected from *China Statistical Yearbook*.

3. RESULTS AND FINDINGS

3.1. Direct Effect and Indirect Effect

This research uses Strata.10 to estimate coefficient of the model. As Tab.1 demonstrated results from Basic Empirical Model confirmed that transport infrastructure investment did have Spillover Effect on non-transport sector (0.045). Further study revealed Spillover Effect during 1990-2000 (0.059) is higher than that of 2001-2010 (0.038) implying that the effect is more significant in the stage of lower developing level.

Considering the fact that China's economy is of unbalanced nature, this research examines the Spillover Effects in different areas, East region, Central region and West region. Results indicated that the Spillover Effects vary considerably across regions (Table 2). The coefficient is 0.1 for east region, 0.084 for Central region and -0.005 for West region. Again, the researcher tested the effect during 1990-2000 and 2001-2010 respectively to see if the effect changes during different stages. Data confirmed that except for west region, Spillover Effect is higher for 1990-2000 than that of 2001-2010. During the first stage, effect in East region is the highest (0.139), followed by Central region. Effect of Central region is the highest (0.092) as economy developed. For West region, however, the effect is negative for first stage and statistically significant only at the second stage. Meanwhile, the Spillover Effect appears to increase for Central and West region, and decrease for East region. Taking account of transport infrastructure in stock and levels of economic development, it suggested that leverage of transport investment changes as economy developed.

Different from other industries, supply of transport infrastructure increased incrementally or developed in a leap-forward way. If transport infrastructure lags behind economic development, it may become bottleneck constraining economic developing potential. In 1990s, transport infrastructure in China is too poor to support demand. But the pressure is much compelling in East Area than the other parts of the country due to the export oriented economy. Highways, sea-ports have been built to meet the requirements. As transport infrastructure improves, boosting effect becomes weaker and weaker. For Central and West regions, on the other hand, economic growth in 1990s is much slower. Than bottleneck effect is more moderate. Late 1990s, Financial Crisis in Asia forced China to expand domestic demand to deal with the crisis. Policies to boost economic development in inland area

(Central & Western) applied investment in transport infrastructure encouraged and Spillover Effect becomes noticeable.

Table 1

Estimation Results from Basic Empirical Model

Total			
Independent Variables	1990-2010	1990-2000	2001-2010
_cons	0.133(0.007)***	0.092(0.021)***	0.099(0.010)***
ky	0.073(0.008)***	0.180(0.062)***	0.119(0.020)***
gl	-0.021(0.019)	0.066(0.113)	0.241(0.074)***
gt*ty	0.400(0.028)***	0.455(0.104)***	-0.900(0.273)***
gt	0.045(0.003)***	0.059(0.012)***	0.038(0.021)*
	Random Effect	Random Effect	Random Effect
East region			
Independent Variables	1990-2010	1990-2000	2001-2010
_cons	0.087(0.016)***	-0.006(0.008)	0.096(0.005)***
ky	0.137(0.027)***	0.402(0.023)***	0.122(0.005)***
gl	0.199(0.050)***	0.582(0.058)***	0.221(0.019)***
gt*ty	-1.136(0.173)***	-1.128(0.104)***	-1.667(0.066)***
gt	0.100(0.010)***	0.139(0.008)***	0.092(0.004)***
	Random Effect	Random Effect	Random Effect
Central region			
_cons	0.135(0.019)***	0.150(0.022)***	0.150(0.014)***
ky	0.051(0.038)	-0.053(0.062)	0.086(0.023)***
gl	0.384(0.121)***	0.284(0.152)*	0.705(0.139)***
gt*ty	-1.671(0.243)***	-0.897(0.322)***	-2.576(0.335)***
gt	0.084(0.013)***	0.073(0.014)***	0.119(0.026)***
	Random Effect	Random Effect	Fixed Effect
West region			
_cons	0.136(0.016)***	0.173(0.008)***	0.170(0.022)***
ky	0.064(0.026)**	-0.032(0.018)*	0.101(0.017)***
gl	-0.188(0.067)***	-0.320(0.025)***	-0.116(0.052)**
gt*ty	-0.088(0.049)*	-0.069(0.011)***	-0.304(0.106)***
gt	-0.005(0.008)	-0.001(0.002)	0.018(0.010)*
	Random Effect	Random Effect	Fixed Effect

Note: parentheses () indicate standard deviation; ***, ** and * indicate significance level of 1%, 5% and 10%

These findings support Liu's (2010) research. Similar findings can also be found in Fernald (1999) which studied the highway investment in America and concluded that the investment impacted the economy with diminishing returns.

An interesting phenomenon is the model exposed that Direct Effect of transport infrastructure on economy is constantly negative which seems surprising. To find the reason, this study used Direct Effect coefficient $\beta_3 = \frac{\delta}{1+\delta} - \theta$ and indirect Effect coefficient $\beta_4 = \theta$ to calculate δ, which denotes the Marginal Productivity Difference between two sectors (Tab. 2). Data shows that Marginal Productivity of transport investment is consistently smaller than that of non-transport sector. In particular, Marginal Productivity Difference in the East and Central region are larger than that of West region.

World Development Report 1994: Infrastructure for Development suggested that when public spending on infrastructure is not well deployed, it may crowd out more productive investment. Because of lower returns, investment in transport infrastructure projects usually carried out by government, which 'crowd out' non-transport investment. Yet, Marginal Productivity (of Labor and Capital) is relatively lower. As a result, less efficient activities bring negative effect on economy growth. Not only that, in Central and East region, private capital market is much more active and backed more activities than West region, which in turn results in more crowding out effect.

Table 2

Marginal Productivity Difference

δ	1990-2010	1990-2000	2001-2010
Nationwide	-0.262	-0.284	-0.463
East region	-0.509	-0.497	-0.612
Central region	-0.613	-0.452	-0.711
West region	-0.085	-0.066	-0.223

3.2. Time Effect

Tab3 presents estimation results of Time Lag model. It proves that the transport infrastructure investment is positively and significantly correlated with economic growth for model with 1-3 year time lag. For models with 4-5 year time lag, however, positive Spillover Effect disappeared. This finding seems to conform to the argument raised by World Bank (1994). The report studied infrastructure investment in developing counties and claimed more often poorly managed infrastructure is the main reason for less satisfied performance. For example, paved roads usually function 10-15 years before resurfacing. But poor maintenance result in severe deterioration within 5 years.

Table 3

Estimation Results from Time Lag Model

1-year lagged			
Independent Variables	1990-2010	1990-2000	2001-2010
_cons	0.129(0.005)***	0.085(0.021)***	0.094(0.015)***
ky	0.057(0.007)***	0.207(0.059)***	0.097(0.022)***
gl	0.191(0.017)***	0.353(0.120)***	0.278(0.086)***
gt*ty	-0.273(0.019)***	-1.196(0.304)***	-0.034(0.101)
gt	0.047(0.003)***	0.089(0.017)***	0.019(0.017)
	Random Effect	Random Effect	Fixed Effect
5-year lagged			
_cons	0.132(0.007)***	0.136(0.020)***	0.114(0.014)***
ky	0.059(0.010)***	0.060(0.054)	0.085(0.018)***
gl	0.153(0.040)***	0.325(0.125)***	0.262(0.087)***
gt*ty	0.122(0.041)***	-0.022(0.296)	0.450(0.091)***
gt	-0.036(0.005)***	-0.037(0.016)**	-0.093(0.013)***
	Random Effect	Random Effect	Fixed Effect

Note: parentheses () indicate standard deviation; ***, ** and * indicate significance level of 1%, 5% and 10% because estimated results for 1-3 year and 4-5 year time lag are very close, Tab. 3 present 1-year, 5-year results only to save space.

Data also showed positive Spillover Effect (for 1-3 year Time Lag) in the first stage (1990-2000) is larger than the second stage (2001-2010) while negative effect is smaller (for 4-5 year Time Lag). Saturation theory may help to explain the phenomenon. Ceteris paribus, Spillover Effect is affected by relative growth rate of transport investment to economic growth. Fig. 1 illustrated that during 1990-2000 high transport investment growth rate provide enough capacity for economic development while lower growth rate during 2000-2010 were surpassed by GDP develpment. As a result, bottleneck effect emerged.

3.3. Spatial Model

Spatial autocorrelation test is one of the most important one in spatial econometrics analysis including Moran's I (Moran 1950), LMerr (Burridge 1980), LMlag (Anselin 1988b), Robust LMerr, Robust LMlag (Anselin et al. 1996) test. Moran's I Value ranges from -1 to +1. Positive (negative) Value indicates positive (negative) spatial autocorrelation cross regions, and "Zero" indicates regionally independent or geographically of random distribution. LMerr and LMlag not only test spatial autocorrelation, but also help to judge models (Eq.11 and Eq.12) (Anselin&Rey 1991; Anselin&Florax 1995). To select the right model, usually OLS method is used to estimate constrained model disregarding spatial autocorrelations factors. If LMlag/RLMlag (LMerr/RLMerr) is statistically more significant than LMerr/RLMerr (LMlag/RLMlag), spatial lagged model or Spatial Error Model is preferred.

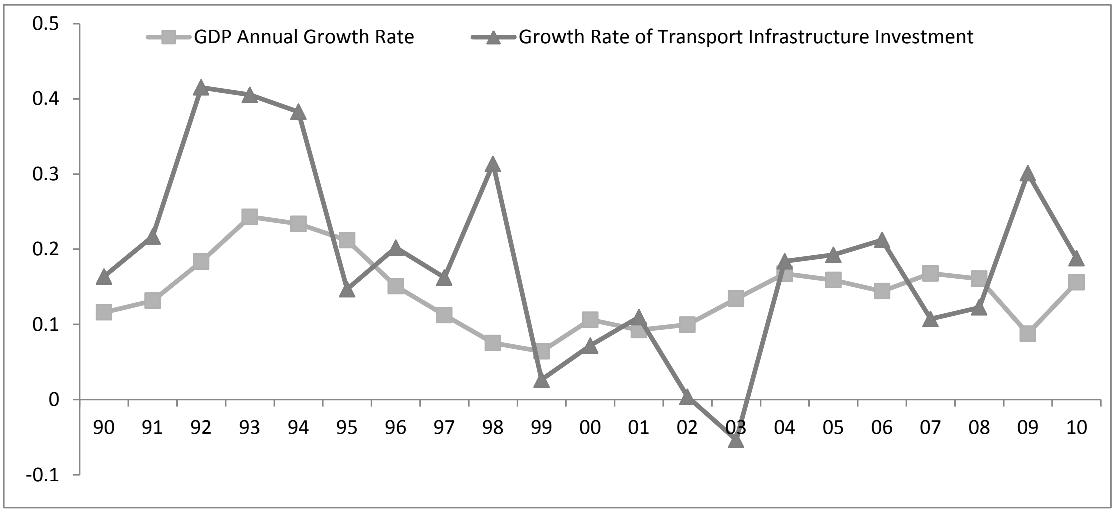

Fig. 1. Rate of Transport Infrastructure Investment and Economic Growth
Abb. 1. Rate der Verkehrsinfrastruktur Investitionen und Wirtschaftswachstum

Table 4

Spatial Correlation Test Results by Region

	Moran's I	LMlag	RLMlag	LMerr	RLMerr
Total					
Test-Value	0.680	810.277	58.338	752.330	0.391
P-Value	0.000	0.000	0.000	0.000	0.532
East region					
Test-Value	0.749	232.750	35.025	197.829	0.103
P-Value	0.000	0.000	0.000	0.000	0.748
Central region					
Test-Value	0.784	167.828	16.739	151.152	0.064
P-Value	0.000	0.000	0.000	0.000	0.801
West region					
Test-Value	0.614	205.238	3.216	202.027	0.005
P-Value	0.000	0.000	0.073	0.000	0.944

This research used Matlab.R2010b software to test spatial autocorrelation factor (Tab. 4). It is easy to find out that Moran's I value are statistically significant evidence of strong positive spatial autocorrelations cross regions.

Based on LM-test, this research adopts the fixed effects SLM model and test two unobserved effects: Region Fixed Effect and Time Fixed Effects. Region Fixed Model excludes regional factors, while Time Fixed Model controlled factors varied with time dimension and Double Fixed Model controlled both regional and temporal factors (Tab5). Data indicated that R^2 and estimated coefficients (Log-likelihood estimation) of the three fixed-effect models are quite close.

For the country as whole, coefficient of Spillover Effect in Region Fixed Effect Model is significantly positive. In other words, improved transport infrastructure of one province has a positive effect on its neighbours. However, transport infrastructure's Direct Effect and Spillover Effect is not statistically significant in the other two models. It is inferred that regional discrepancies, such as economic structure, natural endowments, have stronger influence over transport infrastructure investment. At the same time positive Spillover Effect and negative Direct Effect (conforming to Basic Empirical Model) again directed that transport infrastructure promotes economy by increasing productivity of non-transport sector.

Data also indicates Labor input in non-transport sector makes no significant contribution to economic growth whereas Capital input contributes significantly. Based on Zhang's (1991) findings increased labor inputs contribute less to economic growth due to huge labor supply in China. More than that, because of limited source, this study uses "number of employees at the end of calendar year" to represent labor input, this seems not to be a good analogy.

Spillover Effects impact regional economy in different ways. Not only is that coefficient for East and Central Region steady and significantly positive in three models, but also coefficient of Central Region larger than that of East Region. With favourable geographical conditions, more industrialized economy and export-oriented economic structure, provinces of East Region utilize coastal advantages and enjoy strong Spatial Effect. But in land-locked West Region, mountains blocked cross-border trade and communications, self-sufficient agriculture economy results in rather weak Spatial Effects.

4. CONCLUSIONS

Starting from Feder Model, this paper developed Basic Model, Time Lag Model and Spatial Model to test impact of transport investment on economic growth. With panel data of China's 30 provinces from 1990-2010 it concluded that (1) transport infrastructure has a positive Spillover Effect on economic growth. But the effects varied with regional disparities. (2) Transport infrastructure investment has a negative Direct Effect on economic growth due to marginal productivity differences between sectors. (3) Spillover Effect has a significant time lag. Data from China shows that the effects become negative in 4-5 years. (4) Transport infrastructure has a significant spatial Spillover Effect, which is comparatively stronger for geographically favored industrialized regions.

The above discussion support China's policy to promote economic growth by investing in transport infrastructure. But objective of the policy should aim to support activity of other industries. Meanwhile, more attention should be paid to maintain transport infrastructure already constructed to postpone the time for negative effect. Furthermore, since public investments usually 'crowd out' private investments, policy makers should be prudent to optimize resource allocation. Finally, the spatial Spillover Effects suggested that preferential policies should be made to better transport infrastructure in central areas to magnify the effects.

Table 5

Estimation Results from Spatial Model by Region: 1990-2010

Independent Variables	SLM Panel Model		
	Fixed Region	Fixed Time	Fixed Region& Time
National Total			
ky	0.035(3.188)***	0.078(4.699)***	0.113(5.807)***
gl	-0.028(-0.615)	-0.065(-1.195)	-0.085(-1.586)
gt*ty	-0.199(-3.011)***	-0.123(-1.641)	-0.068(-0.882)
gt	0.026(4.067)***	0.012(1.439)	0.008(0.888)
W*dep.var	0.789(34.664)***	0.317(5.756)***	0.316(5.763)***
R-squared	0.764	0.723	0.747
log-likelihood	1002.405	1071.013	1100.085
East Reagion			
ky	0.077(3.625)***	0.089(3.175)***	0.126(4.301)***
gl	0.115(1.966)**	0.177(2.152)**	0.139(1.655)*
gt*ty	-0.628(-2.591)***	-0.237(-0.886)	-0.179(-0.623)
gt	0.068(4.811)***	0.037(2.088)**	0.034(1.873)*
W*dep.var	0.741(25.030)***	0.223(2.741)***	0.209(2.552)
R-squared	0.867	0.825	0.839
log-likelihood	376.738	420.673	432.188
Central Region			
ky	0.032(2.107)**	0.020(0.561)	0.018(0.446)
gl	0.320(2.905)***	0.202(1.412)	0.141(0.972)
gt*ty	-1.073(-4.236)***	-1.085(-3.574)***	-1.452(-4.444)***
gt	0.059(4.754)***	0.051(3.044)***	0.065(3.669)***
W*dep.var	0.716(21.093)***	-0.138(-1.083)	-0.256(-1.867)*
R-squared	0.853	0.829	0.835
log-likelihood	288.638	353.342	362.439
West Region			
ky	0.023(1.151)	0.046(1.313)	0.122(2.156)**
gl	-0.189(-2.310)**	-0.260(-2.957)***	-0.231(-2.708)***
gt*ty	-0.098(-0.974)	0.089(0.776)	0.198(1.658)*
gt	0.007(0.540)	-0.023(-1.416)	-0.038(-2.248)**
W*dep.var	0.654(13.727)	-0.236(-1.801)*	-0.236(-1.805)*
R-squared	0.587	0.565	0.600
log-likelihood	335.237	390.486	400.107

Note: parentheses () indicate asymptotic t-statistic; ***, ** and * indicate significance level of 1%, 5% and 10%

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