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Effect of the Relocation Policy of Public Agencies in South Korea

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Table of Contents

Tables

Figures

Executive Summary

In 2005, the government announced the relocation policy of public agencies to non-capital regions. The main purpose of the policy was to decentralize population in the SMA (Seoul Metropolitan Area) through building regional competitiveness. The transfer of 98% of the public institutions was completed in April 2017 (MOLIT 2017). However, unlike the blueprint for the initial plan for the relocation of the agencies, there may be an increase in social cost and insufficient contribution to the regional economic development.

This study empirically examines effectiveness of the policy and its impact on regional economic growth and on how differently the policy affects regions depending on the distance from the city for relocation. To measure the policy effect, I use a Difference-in-Difference (DID) model.

After analyzing the effects of the relocation of public institutions on the local economy through research models, there is a policy effect only on the Regional Gross Domestic Production (RGDP) in the target city where the innovation city is located. The model for analyzing the surrounding regions shows that there are not statistically significant effects of the policy on the real GDP and population change, indicating that the effects of public sector relocation policies are hardly visible in the surrounding area. As for the factors affecting the real GDP, the increase in the number of houses and the increase in the land price were found to affect the increase in the real GDP. However, analysis of the population change model for the target areas showed that the coefficient value of the policy effect is not statistically significant. This means that the public agency transfer policy has little impact on the population growth of the regions.

1. Policy Background

In the process of industrialization and urbanization in Korea, the Seoul Metropolitan Area (SMA), consisting of Seoul, Incheon, and Gyeonggi-do, has been overcrowded and the gap between regions has been widened, which resulted in many problems such as deepening of regional imbalances, resentment among people in different areas of the country, and decline of local autonomy (Kim 2008). Within that context, the Roh Moo-hyun government, which began in February 2003, selected the balanced national development policy as one of the main tasks of the central administration.

The concentration of government agencies in the SMA has increased the overcrowding of that area. One sub-policy of the government is relocation of public agencies to local areas with construction of the administrative city and innovation cities to avoid unnecessary concentration of development in the area of Seoul. This policy set up a planning period from 2005 to 2008, a construction period for earth works from 2008 to 2013 and a period of relocating public agencies from 2013 to 2015.

The relocation of public agencies and the construction of innovation cities were initiated to lighten the concentration of political and economic power and overcrowded population in the SMA (Kweon and Ryu 2007).

In fact, the government had been trying to transfer private enterprises, factories, and universities to local areas by strict regulations in the SMA in order to promote balanced national development (Kweon and Ryu 2007). However, there were fundamental limitations in pushing the private sector to move to local areas without any incentives. In 2005, 47.6% of the nation's population, 85% of all public institutions, and 91% of the headquarters of the 100 largest companies were concentrated in the SMA, which was only 11.8% of the national land area (Committee 2005). The government believed that the concentration of public institutions

in the SMA promotes the concentration of private companies in the SMA and is a key factor in preventing the transfer of private enterprises to other provinces (Committee 2005).

The government expected that the relocation of public institutions would contribute to strengthening local growth potential such as an increase of local employment and a better regional innovation system. The Korea Research Institute for Human Settlements (KRIHS) estimated that 180 public institutions (about 32,000 employees) would transfer to local areas that would increase local employment up to 133,000, about 9.3 trillion won in annual production, and a value added inducement effect of about 4 trillion won annually (Committee 2005). The Korean won normally fluctuates between 1000 and 1200 per US dollar. Particularly, relocation of research institutes and educational training institutes was supposed to complement the research functions of local universities and to promote regional economic innovation. In addition, the government also expected the relocation to contribute to an increase in local taxes, activation of the regional economy, expansion of opportunities for higher education and employment, an increase of the quality of local education and expansion of international exchange (Committee 2005).

The transfer of the public institutions was close to 98% complete on April 2017(MOLIT 2017). However, unlike the blueprint of the initial plan for the relocation of the agencies, the plan has some problems such as an increase in social cost and insufficient contribution to the regional economic development. For example, the migration rate of agency staffs without their family members was more than 70%, which resulted into an enormous increase in social costs (Byeon 2016). Moreover, a Doughnut Phenomenon of the old city center has occurred due to the influx of the city center population into the newly built high-grade residential area in innovation cities (Cho 2016). These problems are raising serious concerns that innovation cities may fail.

Table 1. Description of Innovation city projects

Province Or Metro-city	developed Areas[(a)] (km^2)	construction cost[(b)] (billion won)	# of agencies[(c)]	# of employees[(d)]	# of apartment[(e)]	Total local tax[(f)] (billion won)
Busan	9.35	414	13	3,274	2,304	438
Chungbuk	6.899	989	11	3,085	12,614	38
Daegu	4.216	1,437	11	3,451	6,843	72
Gangwon	3.596	884	12	5,843	7,477	68
Gyeongbuk	3.12	877	12	5,452	9,281	55
Gyeongnam	4.93	971	11	3,767	8,057	77
Jeju	1.135	292	8	771	1,741	12
Jeonbuk	9.852	1,530	12	4,927	8,740	94
Jeonnam	7.361	1,322	16	6,812	14,939	128
Ulsan	2.99	1,044	9	3,166	6,044	50
Sum	45	9,760	115	40,548	78,040	1,033

Data Source: (a)(b)(c)(d)(e)-(MOLIT, 2017) , (f)- (Byeon, 2016)
Note
- (b): The construction cost includes the earth work but not includes building costs
- (f): total local taxes paid by the relocated agencies from 2013 to 2015

The purpose of this study is to empirically analyze the impact of regional transfer of public institutions on regional economic development and population development. In particular, I will analyze how innovation cities have affected local economic development and population growth in the surrounding small and medium cities, and examine factors influencing regional economic growth and population growth

2. Importance of this research

This research has several differences to prior research from three perspectives. First, there is no empirical analysis on the impact of the relocation policy that uses quantitative research methods. Second, the unit of analysis of the paper is the smallest administrative level of city. Most research has been organized at the level of province and metro-city. Lastly, this paper compares impacts of the policy on regions for relocation and their neighboring regions.

3. Literature Review

Functions and effects of relocation of public agencies

Cases for local relocation of the public institutions have been found in many developed countries. This policy has mainly been attempted to curb population concentration and to promote balanced regional development. In the case of the United Kingdom, a total of 4,900 people were relocated by 1988 to resolve overcrowding of London's population and to tackle the financial deficit (Bae 2005). To restrain the population concentration of Paris as well as to develop the underdeveloped areas in France, the French government transferred 23,000 public employees before 1990, and thereafter 279 organizations and 30,000 people to the provinces. In the case of Japan, 40 national institutions and 19 public agencies were relocated for resolution of population concentration in Tokyo and decentralized national territory development (Lee 2015).

The transfer of public institutions in Korea was expected to have similar effects to that of overseas cases (transfer of employment to local regions, regional industrial structure improvement effect). According to the KRIHS in 2005, the transfer of 176 public institutions to local areas would lead to the transfer of 130,000 jobs directly or indirectly related to the institutions from the Seoul metropolitan area to other areas. It would result in 9.3 trillion won of the local production increase and 4 trillion won of the value-added inducement effect (Committee 2005). In addition, it was expected that the public-sector employment recognized as high intelligence jobs is expected to have an impact on improvement of local education conditions. It would also be expected that development of specialized regional industries linked with characteristics of public institutions would lead to reform of local industrial structure (Lee 2015). Above all things, the ultimately prospective effects of the relocation

policy can be summarized as 'decentralization of overcrowding population of the metropolitan area' and 'enhancing regional competitiveness' (Committee 2005).

Previous research on impact of the relocation policy on local economies

Previous research on ripple effects of the transfer of public institutions in Korea has mainly been carried out from two perspectives. The first is an analysis of impacts on population and housing. The study on population and housing sector mainly estimated population migration from the Seoul metropolitan area by year. The most recent study, Kim et al. (2013), analyzed the ripple effect on Gyeong-gi Province employment, population, and income (RGDP) of the transfer of public institutions by using vector autoregressive model and a spatial econometric model. The second is an impact analysis on industrial and economic sectors. Most research has estimated economic ripple effects assuming the transfer of public institutions. The KRIHS also analyzed economic effects of construction of innovation cities, operating effects of public agencies and effects of local tax increases. The analytical method is based on the inter-regional input-output table released by the Bank of Korea in 2005 and estimated the ripple effect at the country and provincial level (Kim 2014). This previous research has limitations that they are not based on empirical analysis and the unit of analysis is spatially too broad to measure the effect.

Local population growth as a measurement

Portnov and Etzion (2000) analyzed the impact of population decentralization policy in Israel on regional economic growth. The paper divided six administrative areas into two contrasting groups (core and periphery) to measure policy effectiveness. In the analysis structure, the annual growth rate of population was included as a dependent variable, and the public construction and infrastructure were set as a policy measurement to estimate intensity

of the policy. In order to control the population growth rate, the quantitative analysis included the annual changes in the real GDP as an economic performance of the nation, and the annual number of foreign immigrants and the unemployment change (Portnov and Etzion 2000). The results showed that population growth in the peripheral regions have been stimulated mainly by immigration and public construction. On the other hand, in the core districts of the country, both immigration and unemployment change were the main factors affecting the population growth rate (Portnov and Etzion 2000).

Regional economic growth as a measurement

It is difficult to find an empirical study on impact of the relocation policy even though the regional transfer has just reached over 95 percent (MOLIT 2017). At the same time, it is also hard to find an empirical analysis of the relationship among new town development and local economic and population growth. To overcome this, I looked for examples of impacts of Social Overhead Capital (SOC) on the local economy. The construction of the innovation city through the transfer of the public institutions to local areas can be regarded as a large-scale investment of public capital and the installation of large-scale infrastructure including highway, provincial roads, urban planning roads, apartments, and city parks.

In particular, studies analyzing the correlation between transportation infrastructure and regional economic growth show that transportation infrastructure has a positive impact on the overall growth of the regional economy by improving mobility of population, logistics and information. For example, one study revealed that all transportation infrastructure affects the local economy positively, and that road facilities are more effective in local economies than railways, ports and airport facilities (Lee and Kim 2012). They used the Cobb-Douglas

production function model with panel data of GDP, private capital, labor and transportation infrastructure capital stock of ten province level regions from 1993 to 2007 (Lee and Kim 2012).

The other study estimated impacts of the Korea Train Express (KTX) station on the local economy and regional balanced development (Jo and Woo 2014). They considered GDP as a dependent variable, the population size (demographic change), economic factors (airport, seaport, urban railway, changes of the amount of paved roads) and public factors (change in financial independence of the local government). In addition, the paper added value of distance to the nearest stations, the number of users per unit of distance, and individual stations as the explanatory variables to measure the influence of the KTX stations. The analysis showed that the number of employees, amount of paved roads, and financial independence have statistically significant effects (Jo and Woo 2014).

4. Research Methodology

Research Questions and Hypotheses

To estimate the policy impact, I would like to answer two questions. One is how the relocation policy affects local population and promotion of the local economy. The other is how differently the policy has affected on the local areas depending on distance to the innovation city. To answer these questions, I set up three hypotheses. First, the relocation policy increase local real GDP and population in the target areas which innovation cities are located. Second, the policy has a positive impact on real GDP growth in the surrounding area. Third, the policy has a negative impact on population growth in the surrounding areas.

Research Model

To test the hypotheses, I use the Difference-in-Difference (DID) approach. The DID is a popular research design for estimating causal effects of policy changes and certain policy

interventions (Athey and Imbens 2006, Lechner 2011). The model can be established when outcomes are measured for two groups for two times or more periods. As shown below the Table 2, the treated group is exposed to the policy in the second period, but not in the first period. The other control group is not affected by the policy during any time periods.

Table 2. The Difference-in-Difference estimator (Model 1)

	Before-Policy	Post-Policy	Difference
Group 1 (Treat)	Y_{t1}	Y_{t2}	$\Delta Y_t = Y_{t2}-Y_{t1}$
Group 2 (Control)	Y_{c1}	Y_{c2}	$\Delta Y_c=Y_{c2}-Y_{c1}$
Difference			$\Delta\Delta Y=\Delta Y_t - \Delta Y_c$

Source : (Yi 2016)

As stated above, I would like to measure impacts of the policy on both target areas where the public agencies move and their surrounding regions (SR region) including the target areas. Therefore, I set up the treatment group two different ways. To estimate impacts of the policy on the target cities which the public agencies moved, the treatment group was established with 12 cities for relocation of the public agencies and the control group was set up with the other 149 cities. To measure the impact on the SR, the treatment group was set up with 44 cities and the control group was built with 117 cities. At the same time, I establish the post time period from 2010 because building construction in the innovation cities was started from 2010.

Figure 1. The typical DID estimator in a regression framework

$$Y_{it} = \beta_1 + \beta_2 Treat_i + \beta_3 Post_t + \beta_4 (Treat * Post)_{it} + \beta_5 Control + \varepsilon$$

- ✓ Y_{it} is the outcome of Region *i* and year *t*
- ✓ $Treat_i$ is a dummy if the observation is in the treatment group
- ✓ $Post_t$ is a dummy if the observation is in the post period
- ✓ $(Treat * Post)_{it}$ is a dummy if the observation is both in the treatment and post period
- ✓ Control: other independent variables which affect the outcome

To estimate the DID estimator in a regression framework, the typical regression model is set as the above Figure 1.

The unit of analysis is a municipal city of the smallest unit of the administrative city. Observations for the analysis are 161 local cities out of a total of 226 local cities in Korea from 2006 to 2014. Due to limitation of available data, especially real GDP, the scope of the observation was limited to seven provinces and six metropolitan cities except the Capital Regions and Je-Ju Island.

Since the goal of this paper is to measure the impact of the relocation policy on local economic growth and population growth, I established two dependent variables, real GDP, which is generally well-known as measurement of economic growth, and population. The data is changed into the annual increase rate.

Table 3. Summary of dependent and independent variables

Classification		variables	Unit
Dependent Variables			
	Model Ⅰ	Changes in real GDP	ratio
	Model Ⅱ	Changes in Population	ratio
Independent variables			
	policy effect	Treat (treatment group)	dummy
		Post (post period after 2009)	dummy
		Policy effect (Treat * Post period)	dummy
	economic factors	Changes in real GDP (Model Ⅱ)	ratio
		employees/1000	Units
		companies/1000	Units
	Population factor	Changes in Population	ratio
		Birthrate	ratio
	Infrastructural factor	Amount of new housing /1000	unit
		Changes of land prices	ratio
	Public Factors	Changes of financial independence	ratio

Note: The real GDP at the 2010 current price was derived from the nominal GDP by using the GDP deflator of the country.

Source: the Statistics Korea, a central organization for statistics under the Ministry of Strategy and Finance: http://www.kosis.kr.

The independent variables are categorized into four sets which influence local economic growth. First, changes in the real GDP, for which changes in employees and companies represent economic characteristics. The number of companies and employees directly affect the regional GDP growth rate. The more companies and employees, the larger amount of output is produced. Lee and Kim (2012) stated that an increase in companies and employees promoted local economy growth.

The second one is the rate of increase of population and the annual birth rate. Population growth is the most fundamental factor for urban growth. The increase in population has a significant impact on the regional economic growth due to consumption activity as well as the increase in the labor force (Jo and Woo 2014). Meanwhile, the birth rates were inserted to control for the natural increases in population growth. Seol (2015) analyzed the effects of demographic changes, with structural changes in economically active populations, elderly population, and the birth rate, on the local economy (Seol 2015).

Third, as a characteristic of infrastructure, amount of newly constructed housing and changes of land prices were set up. Much research uses public construction including roads, utilities and public housing, which highly influences local economic growth (Portnov and Etzion 2000, Lee and Kim 2012, Jo and Woo 2014). Especially, the public housing construction accompanies construction of other infrastructure such as road, water supply facilities, sewage treatment and other fundamental infrastructure. Moreover, to control effects of other infrastructure, land price is set up as an independent variable because accessibility of basic infrastructure such as roads, transport and public parks, increase land value (Du and Mulley 2006).

Lastly, the public factor is represented by change of the public financial self-independence. The self-independence is the assessment of local autonomous financial

management capability. In the study of factors influencing the regional economic growth, the increase of the local finance independence promotes regional economic growth (Gang 2008).

5. Results and findings

Descriptive statistics

This paper categorizes the statistics into two groups. One group is divided into the target regions and non-target regions as shown in Table 4. The other group consists of the SR and the other regions as shown in Table 5.

Table 4. Summary of dependent and independent variables (Target - Non Target Regions)

Target Regions (12 cities)					
Variables	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
PC_RGDP	112	0.039	0.095	-0.284	0.360
PC_POP	120	0.005	0.028	-0.030	0.211
N_New_APT_1000	120	1.84	2.88	0.00	20.83
PC_Land_Price	120	2.26	3.44	-3.76	27.71
Birth_Rate	120	1.26	0.21	0.88	1.72
Self_independence	120	27.19	6.81	10.90	50.60
Employees/1000	120	321.80	111.74	170.25	664.24
Companies/1000	120	65.90	9.51	48.00	89.45
Non-Target Regions (149 cities)					
Variables	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
PC_RGDP	1,386	0.027	0.084	-0.542	0.339
PC_POP	1,490	-0.004	0.018	-0.101	0.110
N_New_APT_1000	1,490	0.89	1.80	0.00	15.36
PC_Land_Price	1,490	1.27	1.62	-3.72	17.73
Birth_Rate	1,490	1.35	0.27	0.70	2.47
Self_independence	1,490	20.55	10.35	6.40	57.90
Employees/1000	1,490	329.91	152.61	139.88	1,497.72
Companies/1000	1,490	74.87	28.37	38.44	322.19

Table 5. Summary of dependent and independent variables (SR-Non SR regions)

SR (44 cities)					
Variables	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
PC_RGDP	412	0.034	0.082	-0.339	0.339

PC_POP	440	0.002	0.021	-0.057	0.110
N_New_APT_1000	440	1.22	2.06	0.00	14.10
PC_Land_Price	440	1.46	1.81	-2.37	17.73
Birth_Rate	440	1.32	0.28	0.72	2.19
Self_independence	440	23.11	10.72	6.90	57.90
Employees/1000	440	344.87	142.87	160.08	1,159.36
Companies/1000	440	72.72	31.81	38.44	272.49

Non-SR (117 cities)

Variables	Obs	Mean	Std. Dev.	Min	Max
PC_RGDP	1,086	0.025	0.086	-0.542	0.360
PC_POP	1,170	-0.005	0.018	-0.101	0.211
N_New_APT_1000	1,170	0.87	1.86	0.00	20.83
PC_Land_Price	1,170	1.30	1.84	-3.76	27.71
Birth_Rate	1,170	1.35	0.26	0.70	2.47
Self_independence	1,170	20.27	10.00	6.40	53.90
Employees/1000	1,170	323.45	152.16	139.88	1,497.72
Companies/1000	1,170	74.75	25.70	42.97	322.19

Interestingly, in the first group, the average increase ratios of the real GDP and population in the target regions are slightly greater than those in the non-target regions. The increase ratios of the real GDP and population in the SR are also greater than those in the non-SR. Moreover, the other indicators, including the number of new apartments, changes in land price, self-independence ratio and number of employees per 1000 people, show better figures in both the target and SR regions than non-target and non-SR regions.

Trend of real GDP and Population

The key assumption for the DID approach is that the outcomes in treated and controlled groups should follow the similar time trend in the absence of the intervention (Lechner 2011). However, the outcomes do not need to have the same mean. It is difficult for this assumption to be verified, but pre-treatment data are used to show there are the same time trends (Athey and Imbens 2006). If the outcomes show a different trend, the estimator of the DID model will under-estimate or over-estimate the treatment effects (Lechner 2011). Therefore, it is

necessary to verify whether the real GDP and population have the same time trends before the policy intervention. Figure 2 shows that the population in target regions has a similar trend but real GDP has a slightly different trend during 2009. Meanwhile, as shown in Figure 3, the real GDP shows a similar trend but the population shows quite a different trend.

Figure 2. The year trend of each region (Target regions)

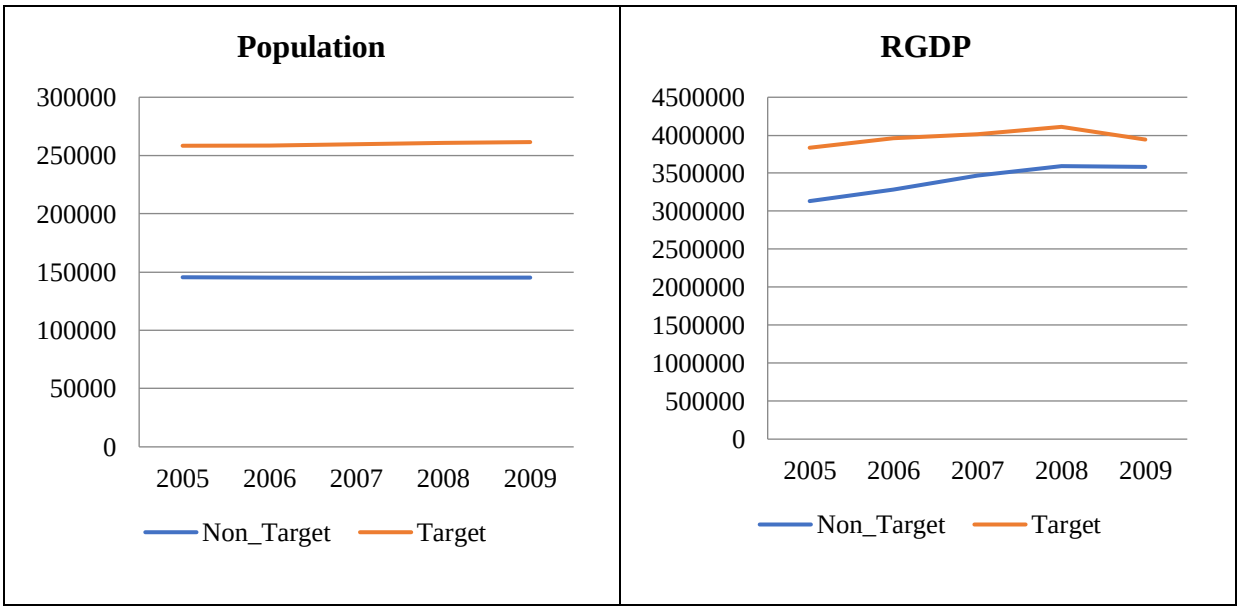
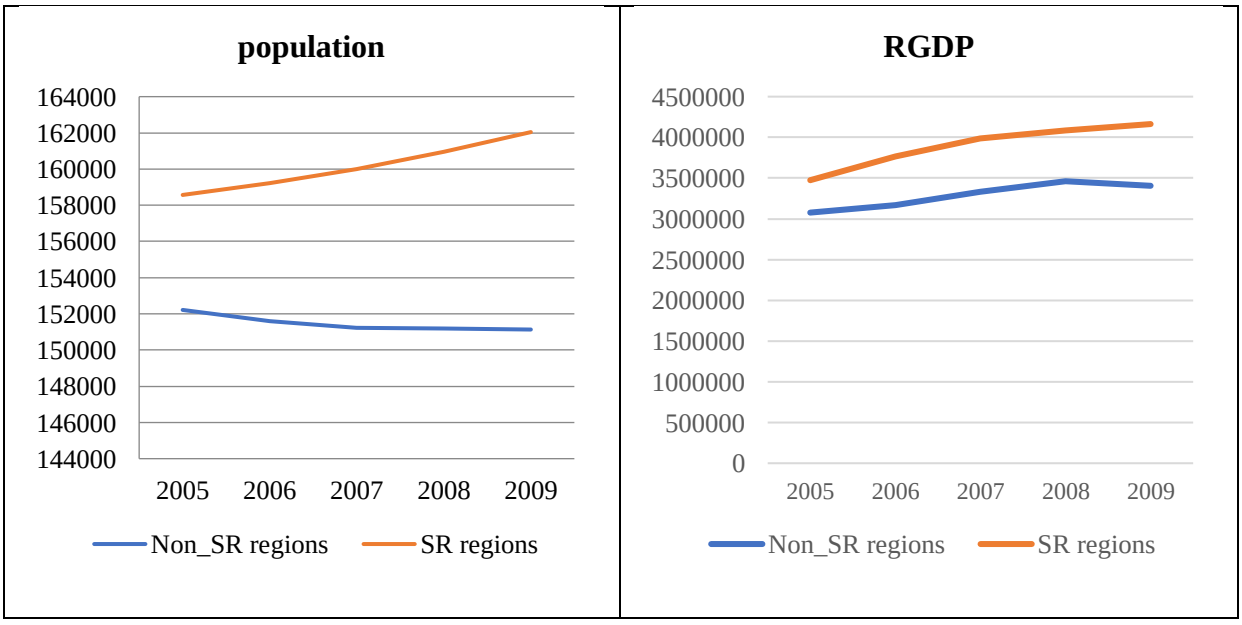


Figure 3. The year trend of each region (SR regions)



The common trend can be testified by a regression model. Without policy impact, as the treatment group shows the same trend, we can set up the regression model as below (Yi 2016). If β_2 is equal to 0, the treatment group has the same time trend with the control group.

$$Y_i = \beta_1 + \beta_2 Treat_i + \beta_3 Control + \varepsilon$$

- ✓ Y_i is the outcome of Region *i*
- ✓ $Treat_i$ is a dummy if the observation is in the treatment group
- ✓ Control: other independent variables which control the outcome

Table 6. Results of the OLS regression analysis to test for common trends in the innovation city

PC_RGDP	Coef.	t		PC_POP	Coef.	T
Region_I (Treat)	-0.02201	-1.73		Region_I(Treat)	-0.00095	-0.56
PC_POP	-0.07025	-0.28		PC_ RGDP	-0.00205	-0.28
N_New_1000	0.00150	0.74		N_New_1000	0.00087	2.32
PC_Land_Price	0.00304	2.28		PC_Land_Price	0.00034	1.74
Birth_Rate	0.04021	2.86		Birth_Rate	0.01837	7.22
Self_independence	0.00032	0.60		Self_independence	0.00088	9.78
Employees/1000	0.00005	1.12		Employees/1000	0.00002	1.42
Companies/1000	-0.00013	-0.67		Companies/1000	-0.00014	-2.36
constant	-0.04753	-1.83		constant	-0.04474	-10.49

Table 7. Results of the OLS regression analysis to test for common trends regions surrounding the innovation city, including it

PC_RGDP	Coef.	t		PC_POP	Coef.	T
Region_I_N(Treat)	0.01684	2.24		Region_I_N(Treat)	0.00708	4.81
PC_POP	-0.16694	-0.66		PC_ RGDP	-0.00467	-0.65
N_New_1000	0.00145	0.72		N_New_1000	0.00083	2.32
C_Land_Price	0.00284	2.09		C_Land_Price	0.00035	1.87
Birth_Rate	0.04653	3.21		Birth_Rate	0.01967	7.68
Self_independence	0.00034	0.66		Self_independence	0.00087	9.97
Employees/1000	0.00004	0.81		Employees/1000	0.00001	1.04
Companies/1000	-0.00005	-0.23		Companies/1000	-0.00011	-1.89
constant	-0.06510	-2.37		constant	-0.04892	-11.49

Table 6 and Table 7 show results of the OLS regression analysis testing the trend. The coefficient of target regions is not statistically significant, so it can be said that there is no evidence to reject that target areas have the same time trend in the absence of the policy. However, the coefficient of SR is statistically significant. Therefore, it cannot be said that the SR regions have the same time trend with the other regions.

Checking Multicollinearity

There are several ways to check the multicollinearity in the analysis. In this paper, I use the Variance Inflation Factor (VIF) in Stata. As "a rule of thumb", if the value of the VIF exceeds ten, there is a multicollinearity problem (Williams 2011). Table 9 shows that all values of the VIF are lower than five, so that there is no multicollinearity problem.

Table 8. Results of the VIF test

RGDP (target regions)		
Variable	VIF	1/VIF
Employees/1000	4.65	0.215004
Companies/1000	4.22	0.237185
T10_R_I	2.26	0.443348
Region_I	2.23	0.448844
Self_independence	2.11	0.473435
PC_POP	1.67	0.600013
N_New_APT/1000	1.44	0.69294
Birth_Rate	1.31	0.763879
T_10	1.18	0.850114
C_Land_Price	1.08	0.926718
Mean VIF	2.21	

POP (target regions)		
Variable	VIF	1/VIF
Employees/1000	4.7	0.212822
Companies/1000	4.27	0.234429
Self_independence	2.11	0.474321
T10_R_I_N	2.05	0.487132
pc_pop	1.69	0.592224
Regio_I_N	1.63	0.61224
T_10	1.54	0.650346
N_New_APT/1000	1.44	0.692808
Birth_Rate	1.32	0.758339
C_Land_Price	1.06	0.94017
Mean VIF	2.18	

RGDP (SR regions)		
Variable	VIF	1/VIF
Employees/1000	4.56	0.219074
Companies/1000	4.12	0.242546
T10_R_I	2.27	0.44105
Region_I	2.23	0.447781
Self_independence	1.96	0.509573
N_New_APT/1000	1.34	0.746537

POP (SR regions)		
Variable	VIF	1/VIF
Employees/1000	4.63	0.216116
Companies/1000	4.19	0.238871
T10_R_I_N	2.05	0.486908
Self_independence	1.95	0.511539
Regio_I_N	1.62	0.618914
T_10	1.52	0.658114

Birth_Rate	1.24	0.80767		N_New_APT/1000	1.34	0.74713
T_10	1.16	0.860576		Birth_Rate	1.24	0.804697
C_Land_Price	1.08	0.927092		C_Land_Price	1.06	0.941156
PC_RGDP	1.03	0.967681		PC_RGDP	1.03	0.973806
Mean VIF	2.1			Mean VIF	2.06	

Results of the Regression analysis

The main purpose of the analysis is to measure the effectiveness of the relocation policy with the measurement of the real GDP and population. The result of the model for the target areas shows that the coefficient value of the policy effect is statistically significant and positive. This implies that the change in the real GDP of the city where the innovation city is located is higher than that of the other cities after the implementation of the relocation policy. Infrastructure factors such as the land price change and increase in apartment are statistically significant, both of which have positive values, indicating that they act as factors for increasing the real GDP.

Table 9. Results of the robust OLS regression analysis for target regions

Model Ⅰ PC_RGDP	Coef.	t		Model Ⅱ PC_POP	Coef.	t	
T10_R_I (Policy Effect)	0.05405	3.24	***	T10_R_I (Policy Effect)	0.00496	1.35	
Region_I (Treat)	-0.02354	-1.87	*	Region_I (Treat)	-0.00085	-0.46	
T_10 (Post)	0.00584	1.21		T_10 (Post)	0.00365	4.47	***
C_Land_Price	0.00246	1.96	***	PC_RGDP	0.00807	1.34	
N_New_APT/1000	0.00267	1.75	*	C_Land_Price	0.00046	2.19	**
PC_POP	0.26234	1.37		N_New_APT/1000	0.00252	3.26	***
Birth_Rate	0.01539	1.61		Birth_Rate	0.01480	9.49	***
Self_independence	0.00000	-0.01		Self_independence	0.00056	5.7	***
Employees/1000	0.00003	0.74		Employees/1000	0.00003	3.27	***
Companies/1000	-0.00012	-0.74		Companies/1000	-0.00017	-4.35	***
constant	-0.00119	-0.07		constant	-0.03663	-12.51	***

*Note: ***: P<0.01, **: 0.01<P<0.05, *: 0.05<P<0.1*

On the other hand, the analysis of the population change model for the target areas showed that the policy effect is not statistically significant. There is no evidence to reject the hypothesis that the public agency transfer policy has little impact on the population growth of the region. In fact, the transfer of public institutions began in 2013 and exceeded 90% in 2016. In addition, the increase in land prices, the increase in the number of apartments, the increase in financial self-reliance, and the increase in the number of employees show a statistically significant positive relationship with population growth. The interesting thing is that the coefficient value of the real GDP is not statistically significant. There is no evidence to reject the hypothesis that real GDP has no impacts on the population.

Table 10. Results of the robust OLS regression analysis for SR regions

PC_RGDP	Coef.	T		PC_POP	Coef.	t	
T10_R_I_N (Policy Effect)	0.00675	0.86		T10_R_I_N (Policy Effect)	-0.00026	-0.15	
Region_I_N(Treat)	0.00196	0.31		Region_I_N(Treat)	0.00433	2.98	***
T_10 (Post)	0.00754	1.35		T_10 (Post)	0.00413	5.02	***
C_Land_Price	0.00223	1.74	*	PC_RGDP	0.00813	1.3	
N_New_APT/1000	0.00270	1.72	*	C_Land_Price	0.00047	2.33	**
PC_POP	0.26965	1.35		N_New_APT/1000	0.00252	3.12	***
Birth_Rate	0.01528	1.55		Birth_Rate	0.01519	9.5	***
Self_independence	0.00000	-0.01		Self_independence	0.00056	5.76	***
Employees/1000	0.00002	0.64		Employees/1000	0.00003	2.87	***
Companies/1000	-0.00011	-0.64		Companies/1000	-0.00015	-3.92	***
constant	-0.00298	-0.16		constant	-0.03860	-12.66	***

*Note : ***: P<0.01, **: 0.01<P<0.05, *: 0.05<P<0.1*

Table 10 shows results of the analysis of the real GDP and population growth in the SR. As a result of the analysis, the policy effect is statistically insignificant. This means that there is no evidence to reject the null hypothesis that the relocation policy has no effect on the surrounding area. In the case of the population growth model, the policy effect is also not statistically significant.

Finding

As a result of analyzing the effects, there is a policy effect only on the real GDP in the target city. Meanwhile, the model for analyzing the SR shows that there are not statistically significant effects of the policy on the real GDP and population change, indicating that the effects of public sector relocation policies are hardly visible in the surrounding areas. If we look at this in connection with infrastructure factors, the increase in land price and the increase in the number of houses have a positive relationship with the increase in real GDP within the region and it is statistically significant. This means that the price of land in the target area is much higher than in other areas, and more apartments have been built in the target area. However, the analysis of the population change model for the target areas shows that the coefficient value of the policy effect is not statistically significant. It means that the public agency transfer policy has little impact on the population growth of the region.

Table 11. Households and population that moved into innovation cities

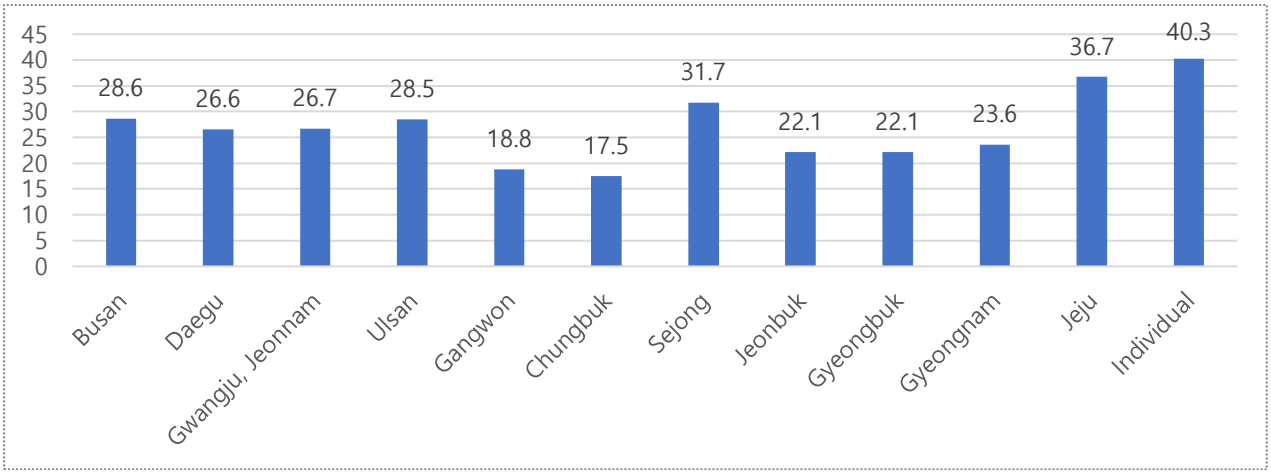
Province		move in	within the region		outside of the region	
Chungbuk	# of Households	2264	1348	60%	916	40%
	population	5819	3648	63%	2171	37%
Gwangju-Jeonnam	# of Households	3390	1789	53%	1601	47%
	population	8396	4973	59%	3423	41%
Gyeongbuk	# of Households	1662	1054	63%	608	37%
	population	4576	3299	72%	1277	28%
Gyeongnam	# of Households	2258	1898	84%	360	16%
	population	6870	5870	85%	1000	15%

Source: Kwon, 2015

In particular, results of the statistically insignificant policy effect on the population both in the target area and the SR have important meaning. Apartments and other facilities

built for the transfer of public institutions did not absorb population of other provinces or the capital region the local and nearby population. The Regional Development Committee under the Presidential Office, as shown in Table 11, reported that more than 60% of the population in the innovation cities moved within the region. In other words, the city rapidly absorbs the population from the surrounding areas (Kwon 2015). In addition, according to the survey conducted by the KRIHS in 2015, as stated above Figure 4, only 28.6% of agencies' employees (26,182 people) moved to the local areas with their families. Insufficient living environment, education and cultural conditions compared to the capital region had them hesitate to move to the region in the absence of attractive incentives (Kwon 2015, Byeon 2016). In particular, the migration ratio was lower in smaller innovation cities than that in big cities due to the unsatisfactory living situation (Cho 2016).

Figure 4. Migration Ratio of Employees with their Families (%)



Data Source: Kwon, 2015

Absorbing population from local and nearby cities produces a variety of problems, such as the Doughnut Effect in the existing city center. The Doughnut Effect occurs when a large-scale new city, which is located adjacent to the old city town, absorbs population and

commerce functions of the city center (Takata, Hayashi et al. 2014). For example, as of 2015, the official land prices of the innovation city in Jinju have risen by an average of 8% over the previous year, while the land prices in the old town center have decreased by 1 to 2% (Seo 2015). This phenomenon produces a decline of existing urban areas and increases social costs, thus negatively affecting regional economic growth.

6. Public Policy Implication

Since the beginning stage of the policy in 2005, the government has expected relocation of the agency to strengthen local economic growth. However, the analysis shows that the policy has only impacted on the increase in the real GDP but not on the population in the target areas. This means that there are physical effects by the construction of the innovation cities, but it failed to increase population. Until now, the government action has been devoted to the physical construction including apartments, office buildings and other basic infrastructures for public institutions and employees. Therefore, the province or local government should focus on more specific goals, such as reinforcing regional innovation and balanced development of the local areas.

The provincial or local government needs to change sub-systems of the local economy by building regional innovation systems. According to Carillo-Hermosilla et al., there are three factors in the processes of environmental innovation: component changes, sub-system changes and system changes (Carrillo-Hermosilla, del Río et al. 2010). The central government has changed the components of the local economic structure. The next step should be followed by the action from local government. The system theory addresses the importance of collective learning and relationships among participants of the system (Moulaert and Sekia 2003). Mostly technological innovation comes from collaboration

between local universities and business associations, especially in the sites of new rising industries such as Silicon Valley, Cambridge and Boston (Benneworth 2006). The relocated public agencies can play a key role as a bridge for collaboration because they are able to cooperate with both the government and the private.

Moreover, the other goal is to promote the balanced development between the old town and the new town in the local. It can be achieved by constructing regional infrastructure through distribution of the local taxes derived from the public agencies. The rapid decline of the urban function in the local area may cause security problems, and insufficient utilization of public facilities and infrastructure which result in excessive social cost. Especially, the Doughnut Phenomenon induces continuous spread of urban outskirts, causing energy, transportation and environmental problems, and leaving the city with an overall economic burden (Kim 2007). Investment in urban infrastructure is considered as a way of raising the competitiveness of the urban region by improving public transport networks and surrounding residential environments (de Magalhães 2015).

7. Limitation

Limitation in Data collection

This study uses the data from the municipal level. This point is different from the previous research on the topic. However, at the same time, there is a limitation to collect clear data for the analysis. Most local governments at the municipal level reported the statistics only since 2005. The data from 2005 was not enough to estimate the time trend in the absence of the policy.

Limitation in Time period for the analysis

As mentioned before, the relocation of the public agencies reached 98% in April 2017. However, the time period of this analysis is limited within 2014 due to lack of data availability, such as the real GDP. In order to see the effects of the policy on the local areas, as the Regional Development Committee expects that the effects of the relocation will be diffused after 2020, the analysis to measure impact of the policy needs more time periods.

Limitation in the Research Model and Recommendation

My second research question is how the policy has affected the local areas differently, depending on the distance to the innovation city. Moreover, economic growth factors such as real GDP and population growth rate are recognized as they are affected by the neighboring regions depending on distance. The spatial analysis is very effective when there is spatial autocorrelation in units of analysis. It is especially useful when the dynamics of one local economy affect development of neighboring local economies through market relationships and trade linkage (Capello 2009, LeSage and Pace 2009, Choi 2017) .

8. Conclusion

The policy of local public transfer was carried out in order to distribute economic power concentrated in the Seoul Metropolitan area to the provinces and to bring about balanced development to the whole country. To this end, it aims at promoting regional economic and population growth by constructing innovation cities and dispersing public institutions. It has been criticized for its lack of success in bringing about regional innovation and lack of effectiveness by distributing the public institutions in too many cities. In this study, the analysis empirically measures the effect of the transfer policy on regional economic growth.

The regression analysis shows that the policy effect is only for the real GDP in the target city where the innovation city is located. Meanwhile, the model for the surrounding regions shows that there is no significant effect on the real GDP change and population change, suggesting that the effects of the public sector local transfer policies are hardly visible in the surrounding area.

The results of this study are as follows. First, housing built for the relocation of public institutions failed to attract population from the other regions. The innovation city has absorbed the population from the local city and its surrounding region. This causes problems such as the Doughnut Effect of the existing old town and increasing social costs due to insufficient use of the existing infrastructure. Second, the effect of the relocation policy has not been shown yet and needs data from more time periods. This is because public institutions started to move four years ago. Therefore, to maximize the effects of the transfer of public institutions and to promote regional economic growth, local governments need to focus on beyond physical development. To do this, they need to strengthen the regional innovation system and promote the balanced development between the old and new towns.

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Appendix A. Results of innovation city construction

Table A-1. Estimated Expenditure for Earth Work Construction of innovation cities

							(million won)
Construction cost	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Sum**
Busan	12,408	16,544	12,408	-	-	-	41,360
Chungbuk	9,890	19,780	19,780	19,780	19,780	9,890	98,900
Daegu	14,369	28,738	28,738	28,738	28,738	14,369	143,690
Gangwon	8,843	17,686	17,686	17,686	17,686	8,843	88,430
Gyeongbuk	8,774	17,548	17,548	17,548	17,548	8,774	87,740
Gyeongnam	9,711	19,422	19,422	19,422	19,422	9,711	97,110
Jeju	2,921	5,842	5,842	5,842	5,842	2,921	29,210
Jeonbuk	15,297	30,594	30,594	30,594	30,594	15,297	152,970
Jeonnam	13,222	26,444	26,444	26,444	26,444	13,222	132,220
Ulsan	10,438	20,876	20,876	20,876	20,876	10,438	104,380
Sum	**105,873**	**203,474**	**199,338**	**186,930**	**186,930**	**93,465**	**976,010**

Table 2. The number of apartments built in innovation cities (units)

Num of Apartment	2010	2011	2012	2013	2014	2015	Sum
Busan	2,304	-	-	-	-	-	2,304
Chungbuk	-	1,110	1,150	1,278	691	8,385	12,614
Daegu	-	350	446	2,423	1,712	1,912	6,843
Gangwon	-	1,110	1,180	2,537	2,232	418	7,477
Gyeongbuk	-	660	1,913	2,226	3,714	768	9,281
Gyeongnam	-	1,779	600	2,223	630	2,825	8,057
Jeju	-	-	477	548	716	-	1,741
Jeonbuk	-	4,134	2,482	552	1,572	-	8,740
Jeonnam	-	1,226	1,948	2,898	5,468	3,399	14,939
Ulsan	-	1,697	3,923	424	-	-	6,044
Sum	**2,304**	**12,066**	**14,119**	**15,109**	**16,735**	**17,707**	**78,040**

Table 3. Local taxes by the public agencies relocated (billion won)

Local Tax	2011	2012	2013	2014	2015	Sum
Busan	-	0	14	18	406	438
Chungbuk	-	1	2	10	25	38
Daegu	-	4	8	22	38	72
Gangwon	-	0	4	15	49	68
Gyeongbuk	-	3	6	14	32	55
Gyeongnam	2	6	22	47	-	77
Jeju	-	1	1	2	8	12
Jeonbuk	-	7	8	50	30	94
Jeonnam	-	5	2	36	85	128
Ulsan	-	0	4	23	23	50
Sum	**2**	**26**	**70**	**238**	**697**	**1,033**