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The Effects of Land Use Deregulations in the Capitol Region on Gross Regional Domestic Product in South Korea

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MPP Capstone

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Executive Summary

South Korea has implemented strong land use regulations controlling the growth of the capitol region (Seoul, and around areas) in order to encourage balanced regional development between the capitol area and the non-capitol area. However, there are ongoing debates about the relationship between the regulatory policies and the balanced regional development.

The purpose of this study is to examine the extent of the effect that the land use deregulation in the capitol region has on growth of both regions. To address this question, I use a difference-in-differences model to empirically analyze how the land use deregulation in the capitol region in 2008 has affected the economic growth of the capitol and non-capitol regions.

The results suggest that the deregulations in the capitol region have no significant effects on the change of GRDP. In other words, the regulatory policy in the capitol region does not promote balanced regional development because the deregulation does not restrict the economic growth of the non-capitol region. Moreover, the GRDP has a high correlation with the factors related to productivity such as economically active population and operating surplus. One possible explanation for this result is that the difference of economic growth between regions depends on the difference of productivity in each region. Therefore, Korea's government needs to consider policies that promote productivity of less developed regions to balance the regional growth.

1. Introduction

Many countries, both developing and developed, have adopted growth management policies for a national development. Typically, growth management policies aim to constrain excessive population growth and urban sprawl, which cause traffic congestion, air pollution, and other urban problems (Cho, 2002). However, some countries adopt growth management policies based on strong land use regulations to solve the problem of uneven regional development (Youn and Kim, 2006). South Korea is an excellent example of a country implementing growth management policies to prevent excessive concentration of population and industry as well as balance regional development for several decades. In particular, South Korea has implemented strong land use regulations controlling the growth of the capitol region (Seoul, and around areas) in order to encourage balanced regional development between the capitol area and the non-capitol area rather than prevent urban ills resulting from overcrowding.

However, there are ongoing debates about the relationship between the regulatory policies and the balanced regional development. Kim, E., and Kim, K.(2003) conclude that although Korea's central government has continuously attempted to introduce various policies to diminish the economic inequality between the six largest developed cities and the other less developed regions, there is no significant evidence that these regulatory policies have decreased economic inequality. Rather, they find that income has been distributed more equally in the largest developed cities than in other less developed regions for the same period. Kim and Lim (2005) maintain that the regulatory policies in the capitol region do not have a positive effect on balanced regional development. Also, they emphasize that negative effects should be taken more seriously because the regulatory policies decrease national competitiveness. On the contrary, Hong and Im (2015) assert that the gap between the capitol and non-capitol regions has been

reduced by the early 2000s. However, in 2008, land use deregulations in the capitol region weakened the economic foundation of the non-capitol region (Hong and Im, 2015).

To my knowledge, there are a lot of studies that analyze how regulatory policies in the capitol region affect economic growth of the capitol and non-capitol regions. However, there are few studies that analyze how land use deregulations in the capitol region influence the economic growth of the capitol and non-capitol regions. Therefore, in this paper I aim to examine the extent of the effect that the land use deregulation in the capitol region has on growth of both regions. To address this question, I use a difference-in-differences model to empirically analyze how the land use deregulation in the capitol region in 2008 has affected the economic growth of the capitol and non-capitol regions. My analysis will help to resolve controversy about the capitol region regulations, which are the backbone of South Korea's growth management policies.

2. Literature Review

In the U.S, since the 1970s many local governments have adopted growth management policies to prevent urban problems like pollution and congestion. After the 2000s, many scholars have carried out studies to evaluate effects of these growth management policies.

Nelson and Peterman (2000) empirically analyze economic effects of growth management policies by comparing "the relative share of total personal income in the U.S" (p. 281) between the metropolitan statistical areas (MSAs) with growth management programs and those without the growth management programs. They use the Ordinary Least Squares (OLS) regression model defining "the dependent variable as the change in the relative share of total personal income" (p. 281), and the experimental variable as the growth management programs.

Their findings show that the growth management programs have a positive influence on the economic performance of local governments.

On the other hand, Saks (2008) and Ogura (2010) maintain that growth management policies restrain the sustained growth of regions that are influenced by those policies. By using simple regression models with fixed effects, Saks examines how land use restrictions influence labor markets in MSAs. This study suggests the land use restrictions have a detrimental effect on the labor markets in MSAs. In particular, these restrictions decrease housing supply, which in turn leads to an upsurge in housing prices. Consequently, the land use restrictions drive workers out of the cities because the workers cannot meet the housing prices in the cities. For this reason, the growth of the labor market is lower in regions with land use restrictions.

Likewise, Ogura's study illustrates the relationship between urban growth controls (UGC) and intercity commuting. To evaluate this relationship, the author applies a gravity model to figure out the flow of intercity commuting in California. Ogura uses an OLS regression to estimate the gravity model. The results suggest that the UGC move workers to the outer areas of a city. The moving of the workers makes commuting time longer and more costly, hence residential development in the city is restricted because "UGC are typically imposed by local jurisdictions without considering the location of workers and firms in nearby places" (p. 2187).

From an Economic perspective, Nandwa and Ogura (2013) assess the effect of urban growth controls on regional production by using utility functions based on Brueckner's (1999) growth control model. Nandwa and Ogura reveal that "with strong agglomeration economies in production, local governments tend to over-restrict population growth, thus leading to inefficiently low production growth" (p. 669).

6

To sum up, local governments, not a central government, adopt growth management policies or urban growth controls in the U.S. Therefore, the purpose of growth management is to entirely prevent urban problems that the residents of areas controlled by local governments are facing. For these reasons, most research dealing with these subjects tends to focus on how the growth management or controls have effects on those regions that adopt the growth management or controls. On the contrary, most studies in South Korea deal with the effects of the growth management policies on balanced development between the developed regions and less developed regions. This is because growth management policies in South Korea aim to support the growth of other less developed regions by restricting the growth of more developed regions. Particularly, the regulations for growth control over the capitol region are the most controversial issue in South Korea.

The study of Lee and Song (2011) advocate that the regulations in the capitol region are necessary to balanced regional development. The authors examine "correlation between the centralization of the capitol region and the regional disparity" (p. 373). For this analysis, they conduct a canonical correlation analysis instead of regression because the theoretical base for causality between the centralization of the capitol region and the regional disparity is yet to be established in academia. The findings of this analysis demonstrate that the high centralization of the capitol region makes the regional disparity worse.

Similarly, Hong and Im's study (2015) emphasize that deregulations of industrial site volume control in the capitol region decrease new construction of factories and firms in the non-capitol region. This study estimates the effects of the deregulations in the capitol region using the Tobit model and OLS regression by the Difference-in-Differences estimator. The results show

that the deregulations lead to new establishments of factories and firms in the capitol region more than in non-capitol region by 1.5 times.

On the other hand, Kim and Lee (2009) empirically examine the effects of the capitol region regulations on the productivity of the non-capitol region. For this analysis, they estimate a production function by the Pooling OLS using the data from the Mining and Manufacturing Survey. The results indicate that the current regulations over the capitol region do not help to improve the development of the non-capitol region and rather reduce national productivity because these regulations do not take into consideration the properties and differences (such as geographical conditions and industrial characteristics) of each region.

Also, Youn and Kim (2006) research how the regulations in the capitol region affect the change of regional productivity. They use the Cobb-Douglas production function to estimate regional productivity and apply panel data analysis to calculate the regulation effects on the regional productivity. The analysis of this paper suggests that the regulations in the capitol region decrease productivity and weaken competitiveness of the capitol region. Furthermore, there is no significant improvement of the non-capitol region after the capitol region regulations.

As we have seen above, even now a variety of scholars and economists are having ceaselessly vigorous debates on the effects of the growth management policies in the capitol region.

3. Background

Historical Development of the Growth Management Policy

In the 1960s, the purpose of the national development in Korea was to reconstruct an economic base that had been destroyed by the Korean War. To establish the economic base,

Korea's government first concentrated on the promotion programs of six strategic cities (Seoul, Pusan, Taegu, Inchon, Daejeon, and Gwangju), which were selected as growth poles. These growth management policies were very successful in rapidly increasing the national growth; however, as graph 1 shows, they also gave rise to excessive population concentration in the capitol region as well as serious social inequality such as an asymmetry between regions (Kim, 2003).

Graph 1. Population 1970~2014
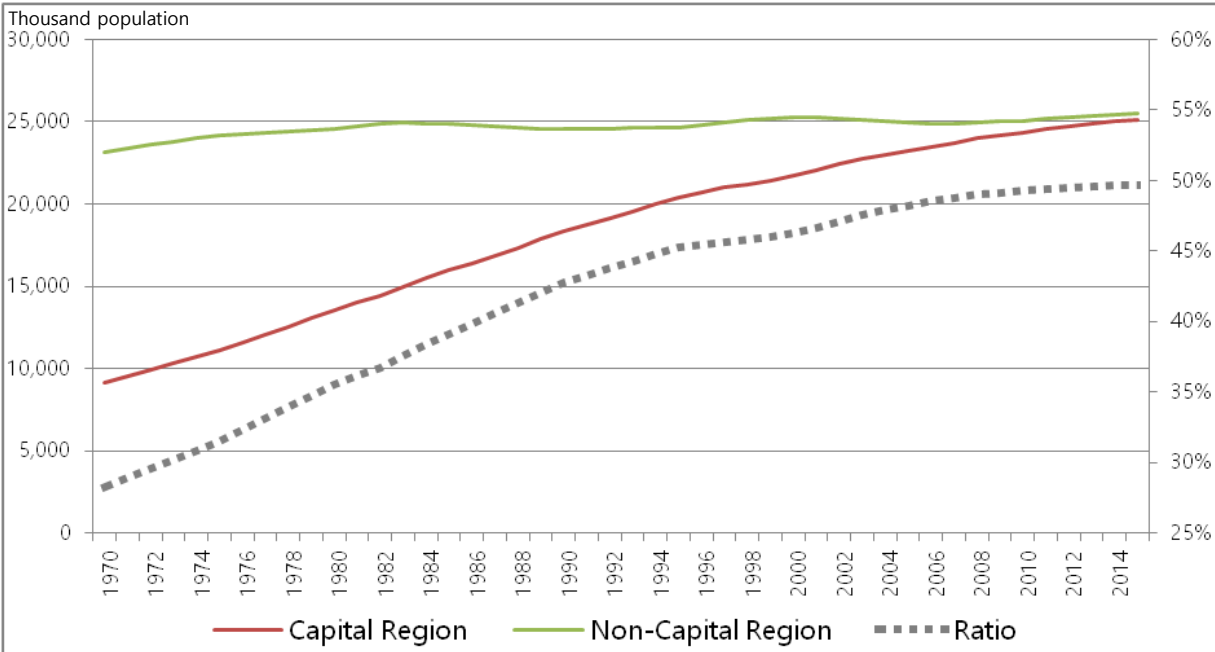
Note. The growth management policies lead to population concentration into the capitol region. Source : The Statistics Korea.

For these reasons, during the 1970s the Korean government shifted the aim of the growth management policies from fueling the national growth to supporting balanced regional growth. The changed growth management policies focused on preventing enlargement and centralization of metropolitan areas, especially the capitol region (Seoul, Inchon and Gyeonggi), so that less developed regions can catch up with the developed regions. In particular, in 1982

Korean government enacted the Capitol Region Readjustment Planning Act (CRRPA), which was based on strong regulations of land use. The core purpose of the CRRPA is to restrict facilities (factories, universities, etc.) enticing population and money (OECD, 2009). Under the CRRPA, the capitol region has been classified into three different districts: Overpopulated Constraint District [1], Growth Management District [2], and Nature Conservation District [3]. According to the classification, The Korean government has allocated the quota on the new construction of industrial facilities and buildings and limited the expansion of existing factories and academic institutions. Since then, the Korean government has adhered to the strong land use regulations in the capitol region.

Administrative Divisions of South Korea

As table 1 shows, South Korea consists of 1 special city, 1 special autonomous city, 6 metropolitan cities, 8 provinces (formally called "Do"), and 1 special self-governing province. These are subdivided into 227 lower level local governments. The capitol region includes three different administrative divisions: Seoul, Incheon, and Gyeonggi-do. It is the center of economy, business, industry, and culture in South Korea.

Table 1. Administrative Divisions of South Korea

Division	Name	Area (km^2)	Population (Million)	Note
Special city[4]	Seoul	605	10.20	The capitol region
Special autonomous city[5]	Sejong	465	0.11	

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1 Districts where dispersion of population or factories into other districts is needed due to the excessive concentrate of population and industry

2 Districts where growth management is needed for sustained growth

3 Districts where development is restricted for the natural environment conservation

4 The capital city of South Korea

Metropolitan cities[6]	Busan	770	3.54	
	Daegu	884	2.51	
	Daejeon	540	1.52	
	Gwangju	501	1.47	
	Incheon	1041	2.84	The capitol region
	Ulsan	1060	1.15	
Provinces[7]	Gyeonggi-do	10171	12.10	The capitol region
	Gangwon-do	16874	1.54	
	Chungcheongbuk-do	7406	1.57	
	Chungcheongnam-do	8204	2.10	
	Gyeongsangbuk-do	19029	2.70	
	Gyeongsangnam-do	10535	3.32	
	Jeollabuk-do	8067	1.91	
	Jeollanam-do	12267	1.91	
Special self-governing province[8]	Jeju-do	1849	0.58	

Note. South Korea consists of 1 special city, 1 special autonomous city, 6 metropolitan cities, 8 provinces, and 1 special self-governing province. Source : http://www.korea.net/Government/Constitution-and-Government/Local-Governments.

The Mitigation of the Capitol Region Regulation

In 2008, Ministry of Land, Infrastructure and Transport (MOLIT) mitigated or abolished considerable regulations limiting new industrial establishments and the expansion of existing industrial facilities in the capitol region by "the Effective Management of Land Use for Enhancing National Competitiveness". In particular, this act allowed development, expansion,

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5 The administrative capital city of South Korea

6 The first-level administrative divisions in South Korea, metropolitan cities have the equal rank to the provinces

7 The first-level administrative divisions in South Korea, provinces have the equal rank to the metropolitan cities

8 The province with more autonomous rights over its economy

and relocation of firms and factories in industrial complexes of the capitol region, regardless of size or category of industry. Also, the act permitted existing factories of the high-tech industry outside industrial complexes to expand their size. In other words, the Korea's government allows almost all establishment and expansion of industrial facilities in the capitol region, regardless of the size of factory and category of industry. This deregulation has been one of the drastic changes in the regulatory policies because there was rare permission for any new construction or expansion before 2008, except for only 8 categories in the high-tech industry (BYUN et al., 2011). Table 2 shows the summary for the mitigation of industry regulations.

Table 2. The Mitigation of the Capitol Region Regulation for industry

The type of district	Firm size	The type of zoning		Pre-deregulation	Post-deregulation
Overpopulated constraint district	Large-sized firm	Industrial complex		Prohibition	**Permission**
		Other	Industrial zone	Prohibition -Exception: Expansion of high-tech industry within 1000m²	Prohibition -Exception: Expansion of high-tech industry **within 200%**
			Other	Prohibition -Exception: Expansion of high-tech industry within 1000m²	Prohibition -Exception: Expansion of high-tech industry **within 100%**
	Small and medium-sized firm			Permission	Permission
Growth management district	Large-sized firm	Industrial complex		Prohibition	**Permission**
		Other	Industrial zone	Prohibition -Exception: Expansion within 3000m²	**Permission**
				Relocation(8 categories)	**All categories**
			Other	Prohibition -Exception: Expansion of high-tech industry within 100%	**Permission**
	Small and medium-sized firm			Permission	Permission

Note. The Korea's government allows all establishment and expansion of industrial facilities in the capitol region.
Source : Ministry of Land, Infrastructure and Transport (2008).

4. Research Methodology

Research Design

To estimate the effect that the deregulation of the capitol region has on the economic growth of the capitol and non-capitol region, this study uses a difference-in-differences (DID) model. Typically, the DID model is utilized to evaluate the effects of public policies. The treatment effect in Figure 1 indicates the net effect of a public policy, after general effects like time trend and business cycles are eliminated. In particular, one can find the treatment effect by calculating the difference in the average change before and after the policy was applied to the treatment group (one group affected by a policy) and the control group (not affected by the policy).

Figure 1. The difference-in-differences estimator of the treatment effect

- y_i : The outcome of individual i
- θ_0 : The non-receipt of treatment, θ_1 : The receipt of treatment
- t_0 : Pre-treatment period, t_1 : Post-treatment period

	t_0	t_1
Control group (λ_0)	θ_0	θ_0
Treatment group (λ_1)	θ_0	θ_1
Treatment effect	$(E[y_{t1}\,|\lambda_1,\,\theta_1] - E[y_{t0}\,|\lambda_1,\,\theta_0]) - (E[y_{t1}\,|\lambda_0,\,\theta_0] - E[y_{t0}\,|\lambda_0,\,\theta_0])$	

Note. The treatment effect is the difference in the average change before and after the policy was applied to the treatment group and the control group. Source: Blundell, R., Brewer, M. & Shephard, A. (2005).

This paper uses the ordinary least squares (OLS) regression with the DID estimator to measure the policy effect, which is the result of deregulation in the capitol region. The equation is presented as follows. The treatment group is the capitol region because the regulatory policies have been applied for the capitol region. Also, I denote the period after the deregulation in the capitol region as *Time*=1 and the period before this as *Time*=0.

$Y_{i,t} = \beta_0 + \beta_1 Treat + \beta_2 Time + \beta_3(Treat \times Time) + \beta_4 Control + \varepsilon$

- $Y_{i,t}$: The outcome of Region i in year t

- *Treat* : The dummy variable indicating the statue of treatment (Non-treat = 0, Treat = 1)

- *Time* : The dummy variable indicating time period (Pre = 0, Post = 1)

- *Treat* $\times$ *Time* : The policy effect

- *Control* : The general socio-economic variables affecting the outcome

Figure 2. The regression equation for the difference-in-differences model

Note. The ordinary least squares (OLS) regression with the DID estimator to measure the policy effect, which is deregulation effects in the capitol region.

The dependent variable for this regression model is the Gross Regional Domestic Product (GRDP) of each region (*i*). The improvement of the GRDP in the non-capitol region is one of the most important goals of the capitol region regulations (Youn and Kim, 2006). Therefore, comparing the change of the GRDP between the capitol and non-capitol region is a reasonable method of examining the policy effect of the deregulations over the capitol region. With regard to independent variables, the model includes dummy variables for a treatment group (The capitol region = 1, the non-capitol region = 0) and for time period (before 2008 & 2008 = 0, after 2008 = 1), and an interaction term indicating the policy effect caused by the deregulation. Also, my study includes control variables affecting the GRDP with reference to the related literature. The description of variables is presented in Table 3.

Table 3. The description of variables

	Variable	**Measurement**
Dependent variable	GRDP	Korean Won in billions (at constant 2010 prices)
Independent variable	Treatment group	Non-capitol region = 0 Capitol region = 1

		Time	before 2008 & 2008 = 0 after 2008 = 1
		Policy effect	*Treat × Time*
Control variable	Economic factor	Operating surplus[9]	Korean Won in billions
		Economically active pop[10]	Number in thousands
		Recession[11]	2008 ~ 2009 = 1 Others = 0
	Social factor	Gender Rate	Percentage of male
		College Grad Rate	Percentage

Note. This analysis includes independent variables to estimate policy effects and control variables to estimate general effects.

Data Collection

This study utilizes data sets extracted from Korean national statistics during 2000 - 2014. Since the capitol region regulations were mitigated in 2008, the time period of the data sets would be suitable for analyzing the change before and after the deregulation. The variables of "GRDP" and "operating surplus" are from Regional Account; the variables of "gender rate" and "college grad rate" are from Population Census; and the variable of "economically active pop" is from Economically Active Population Survey.

Summary statistics, divided into two groups of the capitol and non-capitol region, are presented in Table 4. As evidenced by the table, the average values of all economic indicators in the capitol region are much higher than those in the non-capitol region.

Table 4. Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
The capitol region (Treatment group)					
GRDP (Billion Won)	45	182831	100651	38192	314160

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9 The proxy variable of capital stock to estimate impact of capital input (Youn & Kim, 2006)

10 The variable to estimate impact of labor input (Youn & Kim, 2006)

11 The variable to estimate impact of global financial crisis of 2008–09

Operating Surplus (Billion Won)	45	63272	45374	6639	145996
Economically Active Pop (Thousand Pop)	45	3964	1930	1163	6442
College Grad Rate	45	36.75	8.14	20.29	53.25
Gender Rate	45	59.37	1.53	55.76	61.48
The non-capitol region (Control group)					
GRDP	195	44770	22118	7612	102835
Operating Surplus	195	8101	4640	1768	22935
Economically Active Pop	195	944	402	268	1773
College Grad Rate	195	30.93	8.60	14.20	49.34
Gender Rate	195	57.87	2.39	52.16	66.67
Other dummy variables: Treatment group, Time period, Policy effect, Recession					
Total observations: 240 on 16 Provinces and cities, Year : 2000 ~ 2014					

Note. Summary statistics, which is divided into two groups of the capitol and non-capitol region.

Overview of the GRDP

Most of all, the essential assumption for the DID model is that the GRDP in the capitol region (treatment group) and the non-capitol region (control group) would have the same trends in the absence of the policy change (Gruber, 2013). If one group shows a different trend from the other group in the absence of the policy change, the estimate of the DID model will be distorted. Therefore, it is necessary to monitor trends of the GRDP of both regions before the policy change. In Graph 2, both regions have steadily increased their GRDP with similar pace from 2000 to 2008; thus, we can assume the GRDP follows the same trend in the absence of the policy change. Table 5 shows the average annual increasing rate of GRDP of both the capitol and non-capitol region. For the time period from 2000 to 2008, the capitol region had 0.46% higher increasing rate than the non-capitol region. However, after 2008, the capitol region has maintained the same rate as the non-capitol region.

To sum up, the deregulations in the capitol region did not encourage the economic growth of the capitol region; at the same time, the deregulations did not hamper the economic

development of the non-capitol region. To analyze accurately this explanation, this paper conducts the OLS regression with the DID estimator in next section.

Graph 2. The yearly GRDP of each region
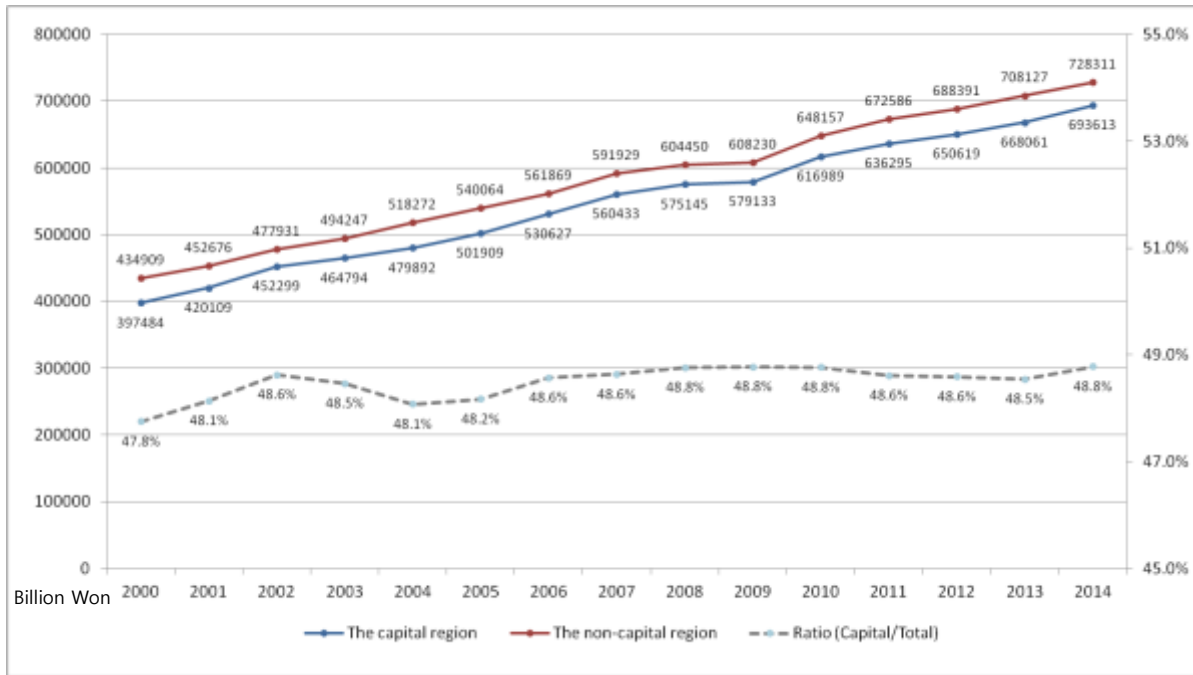
Note. Both regions have steadily increased their GRDP with similar pace from 2000 to 2008.

Table 5. The average annual increasing rate of GRDP

	Total	2000~2008	2009~2014
Capitol region	3.78%	4.19%	3.05%
Non-capitol region	3.50%	3.73%	3.05%

Note. the capitol region has maintained the same rate as the non-capitol region after the deregulations.

5. Analysis and Results

Before I do the OLS regression analysis, I have to verify if the data support the assumption about OLS regression because the wrong data can lead to incorrect results of the

analysis. For this purpose, I check the homoscedasticity of residuals and multicollinearity among the independent variables.

Checking Homoscedasticity of Residuals

Homoscedasticity of residuals is one of the most critical assumptions for the OLS regression. The homoscedasticity means that the variance of residuals is constant across the variables (Hansen, 2016). If the residuals do not have constant variance (Heteroscedasticity), it is a common solution to use OLS regression with a "robust" option of Stata. In this paper, I do the Breusch-Pagan/Cook-Weisberg test to check whether or not the variance of the residuals is homogenous. As we can see from Table 6, since the P-value is very small, the hypothesis that the residuals have constant variance is to be rejected. Therefore, we can see that the variance of the residuals shows the heteroscedasticity.

Table 6. The result of Breusch-Pagan/Cook-Weisberg test

Ho: Constant variance Variables: fitted values of GRDP	
chi2(1) = 8.21	Prob > chi2 = 0.0042

Note. The hypothesis that the residuals have constant variance is to be rejected.

Checking Multicollinearity

The multicollinearity means the situation in which two or more of the variables are highly correlated (Hansen, 2016). When the multicollinearity exists, it makes the standard errors greater and estimates of the coefficients unstable and sensitive. As a result, in the presence of the multicollinearity, it will be difficult for the null hypothesis to be rejected.

I use the VIF (variance inflation factor) to detect the multicollinearity. Typically, when the VIF value is higher than 10 or the tolerance value(1/VIF) is lower than 0.1 there is high

multicollinearity. The result of the VIF test indicates the variables have no values of 10 or above. Although all variables remain under 10 point, "Economically Active Pop" and "Operating Surplus", with quite high VIF values, might be considered as factors to lead to the incorrect result of the regression analysis. However, it is common that variables are highly correlated in time series, but their changes are not strongly correlated (the correlation by the time trend is to be dealt with in next section). Therefore, there is no problem with the multicollinearity here.

Table 7. The result of VIF

Variable	VIF	1/VIF
Economically Active Pop	8.22	0.121678
Operating Surplus	7.57	0.132168
treat	3.43	0.291964
Policy effect	2.04	0.490289
College Grad Rate	1.66	0.60287
time	1.61	0.621736
Gender Rate	1.14	0.87538
recession	1.02	0.982091
Mean VIF	3.33	

Note. The result of the VIF test indicates the variables have no values of 10 or above.

Spurious Correlation by the Time Trend

As Table 8 shows, this regression demonstrates spurious correlation owing to the time trend and should not be reported in the results. In the presence of time trends, all variables predict each other regardless of whether they actually have any economic or policy relationship at all. This is called spurious regression meaning regression only through growth, not through

any real relationship. This regression shows that GRDP grows over time. The solution is to apply the first differencing operator[12] to this model.

Table 8. The result of the robust regression including GRDP, year, and intersection variables

Variable	Coefficient	Std. Err.	t	P>t
Year	1329.808	474.8115	2.8	0.006
Intersection (Provinces and cities ×Year)				
Chungcheongbuk-do	-2376.94	278.0066	-8.55	0.000
Chungcheongnam-do	1613.592	183.1512	8.81	0.000
Daegu	-2399.93	211.0092	-11.37	0.000
Daejeon	-3528.38	283.1932	-12.46	0.000
Gangwon-do	-3211.2	261.4519	-12.28	0.000
Gwangju	-3652.92	304.503	-12	0.000
Gyeonggi-do	18528.04	750.9582	24.67	0.000
Gyeongsangbuk-do	1380.135	53.37959	25.86	0.000
Gyeongsangnnam-do	1854.846	70.32829	26.37	0.000
Incheon	-549.389	101.1032	-5.43	0.000
Jeju-do	-5066.22	400.4521	-12.65	0.000
Jeollabuk-do	-2684.78	222.8736	-12.05	0.000
Jeollanam-do	-557.047	74.87295	-7.44	0.000
Seoul	21417.03	1549.112	13.83	0.000
Ulsan	-9.07419	50.8653	-0.18	0.859
_cons	49638.94	4897.81	10.13	0.000

Number of obs = 240
F(16, 223) = 222.97
Prob > F = 0.0000
R-squared = 0.8907

Note. This regression shows spurious correlation owing to the time trend and should not be reported in the results.

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12 "The dth differencing operator applied to a time series x is to create a new series z whose value at time t is the difference between $x(t + d)$ and $x(t)$. This method works very well in removing trends and cycles." (Newton (1999), Slide 4).

The Results of the Regression Analysis

Since the variance of the residuals of the data shows the heteroscedasticity, I run a robust regression using Stata (statistical software). Of course, all variables will be in change form, including dummy variables, to solve the problem of the spurious regression.

Table 9 shows the result of the first-difference regression. According to the regression results, the "Policy effect" variable, which interprets the effect on the deregulation in the capitol region, is not statistically significant. In terms of the control variables, all variables but "College grad rate" are statistically significant Indicators of the GRDP at the 5% level.

The prime purpose of the analysis is to evaluate the effect of the deregulation in the capitol region using the treatment variables. The interpretation of the treatment variables is central to this regression model. First, the variable "Treat" is significant (Coefficient = 2529.62, P-value = 0.001). The variable "Treat", which refers to just the capitol region, can be included to show that when other variables are equal the capitol region grows faster. Second, the "Time" variable is also statistically significant (Coefficient = -1246.82, P-value = 0.002). It indicates that first differenced GRDP has considerably decreased after 2008. Lastly, the "Policy effect" variable, which shows the difference-in-differences estimator on the mitigation of the capitol region regulations, is not statistically significant (Coefficient = -2284.12, P-value = 0.187). it means that when the regulations of the capitol region are mitigated, GRDP does not experience any significant change. In other words, there is no correlation between the deregulation and the economic growth of the capitol region as well as the non-capitol region. Also, regardless of the statistical significance of the "Policy effect" coefficient, we cannot suggest that the deregulation policy has a negative effect on the GRDP of the non-capitol region since the coefficient has negative values.

In terms of control variables, "Economically active pop", "Operating Surplus", and "Gender Rate" have a positive effect on "GRDP". In other words, factors related to productivity contribute to the growth of GRDP. Variable "Recession", which is included to estimate sudden changes occurring in time-specific trends, has a negative effect on GRDP. It means that the global financial crisis of 2008–09 led to downturn in economic activity in South Korea.

Table 9. The result of the robust regression with differenced variables

Variable	Coefficient	Std. Err.	t	P>t
Economically Active Pop D1.	37.86898	7.323061	5.17	0.000
Operating Surplus D1.	0.257767	0.114129	2.26	0.025
College Grad Rate D1.	-14.2368	118.557	-0.12	0.905
Gender Rate D1.	431.0187	207.2858	2.08	0.039
Recession D1.	-967.5	418.077	-2.31	0.022
Treat	2529.62	775.7482	3.26	0.001
Time D1.	-1246.82	392.2069	-3.18	0.002
Policy effect D1.	-2284.12	1727.376	-1.32	0.187
Cons	1339.878	207.225	6.47	0.000

Number of obs = 224
$F_{(8, 215)}$ = 15.72
Prob > F = 0.0000
R-squared = 0.6488

Note. According to the regression results, the "Policy effect" variable, which interprets the effect on the deregulation of the capitol region, is not statistically significant.

Findings

This paper empirically analyzes the relationship between the GRDP of each region and the deregulation in the capitol region using OLS regression with the difference-in-differences estimator. Consequently, the results of the regression model do not demonstrate any statistically significant relationship between the GRDP of each region and the deregulation in the capitol region. In other words, this analysis does not (at least statistically) provide any evidence to support assertions that the mitigation of the regulations in the capitol region hindered the

economic growth of the non-capitol region or gave an unfair advantage to the capitol region. These findings are somewhat consistent with the results found by Youn and Kim (2006) in their empirical analysis. Both this paper and Youn and Kim's paper (2006) investigate the effect of the capitol region regulations by estimating the change of the GRDP. The results of the analysis point out that the effects are insignificant to the GRDP, an indicator showing regional economic development.

Limitation

For more cohesive results, this study might need a larger number of samples, including data of lower-level local governments. However, since the Korean National Statistical Office does not provide the data of lower level for GRDP, I cannot include sufficient data numbers. Moreover, a further analysis needs to consider not only GRDP but also other economic factors such as the change of income or employment rate as the dependent variable. Various studies produce a variety of alternative explanations on the effect of deregulations in the capitol region. Therefore, the additional dependent variables and sufficient data, including lower-level local government, can strengthen the reliability of the analysis on the effect of deregulations in the capitol region.

In addition, the DID estimate assumes that there is no sudden impact affecting the outcome in the presence of a policy change. However, since it is impossible to include all variables to control for all possible sudden impact, the outcome would be biased due to unobserved variables. This problem is also likely to be solved by increasing the number of observations and implementing long-term study.

6. Conclusion

This paper investigates the effects of deregulation in the capitol region on GRDP in South Korea by using OLS regression analysis with the DID estimator. Since the deregulation in the capitol region happened in 2008, this study includes the time period between 2000 and 2014. The main purpose of this paper is to address the question about whether or not the regulation in the capitol region supports balanced regional development by examining the extent of effect that the deregulation has on the economic growth in the capitol and non-capitol region.

The results suggest that the deregulations in the capitol region have no significant effects on the change of GRDP. In other words, the regulatory policy in the capitol region does not promote balanced regional development because the deregulation does not restrict the economic growth of the non-capitol region. Moreover, as we have seen from the results of the analysis, the GRDP has a high correlation with the factors related to productivity such as economically active population and operating surplus. Therefore, one possible explanation for this result is that the difference of economic growth between regions depends on the difference of productivity in each region, instead of the presence of regulations. This explanation supports Seo (2001) and Park et al. (2004)'s contentions that high growth rate of the capitol region results from higher total factor productivity in the capitol region than other regions. In this regard, Korea's government needs to consider policies that promote productivity of less developed regions to balance the regional growth.

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Data Sets

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