# CHAPTER 5. EMPIRICAL RESULTS AND MODEL TEST

The purpose of this paper probes whether region's political power in the central government insignificantly influences regional FDI or not and what its sign is. Meanwhile, this paper includes other variables to explain the factors which represent the province's economy, living level of a region, labor cost, a region's infrastructure, the degree of provincial openness and agglomeration effect. Moreover, this paper uses an empirical model to examine the result. Panel data analysis is adopted because this paper examines the determinants of FDI distribution across provinces and over time. Thus, this paper will express the empirical results. Furthermore, several tests are conducted to ascertain whether the empirical results can provide accurate conclusions.

## 5.1 Empirical Results

As a matter of fact, numerous political and economical factors will attract regional distribution of FDI in China. This paper uses political power as a new variable that no one has considered it as a political factor of determining FDI in China before. Thus, this study uses empirical model to examine the result.[74] The estimation results of all the specifications are presented in Table 11. Prior to the discussion of the empirical results, several tests are conducted to ascertain whether the empirical results can provide accurate conclusions.

For all of these variables, the regression yields the expected relationships between FDI and other variables. For *GPP*, *PER*, *HIWAY*, and *AFDI*, the regression

[74] Limited observations and excess provincial parameters make regression model multicollinearity and inappropriate results so this paper shifts the fixed effects model to the ordinary least squares model.

Table 11：Estimation Results of OLS Model

| Variables | Coefficient | | t-value |
|---|---|---|---|
| *CONSTANT* | -10.3456 | *** | -4.545 |
| log *GPP* | 0.9874 | *** | 18.922 |
| log *PER* | 0.9582 | *** | 6.888 |
| log *WAGE* | -0.3010 | | -0.991 |
| *HIWAY* | 1.3385 | *** | 4.058 |
| *OP* | -0.1465 | *** | -3.336 |
| *AFDI* | 0.6224 | *** | 9.525 |
| *CCPB* | 0.3916 | ** | 2.378 |
| $CCPB \times T$ | -0.1498 | *** | -4.184 |
| *COASTAL* | 0.1160 | | 1.118 |
| *Y*99 | -0.2434 | | -1.790 |
| *Y*00 | -0.3027 | | -2.055 |
| *Y*01 | -0.2501 | | -1.504 |
| *Y*02 | -0.2702 | | -1.305 |
| *Y*03 | -0.5021 | | -2.059 |
| *Y*04 | -0.1281 | | -0.492 |
| *Y*05 | -0.1643 | | -0.620 |
| *Y*06 | -0.8892 | | -0.281 |
| Sample Size | | | 270 |
| Adjust $R^2$ | | | 0.8682 |
| One Way: F-Statistic | | | 105.24 *** |
| B-P Statistic: $\chi^2$ | | | 133.66 |
| LM Test | | | 0.9512 |
| RESET Test | | | 0.7723 |

Notes: 1. Symbols ***, **and * denote that null hypothesis of estimated parameter equal to zero is rejected at 1%, 5%and 10% significance level.

2. Dependent variable is the amount of foreign direct investment.

3. The results of regression model are corrected for heteroskedasticity by White (1980).

finds a positive relationship, statistically significant at the 1% level. *OP* and *CCPBT* are found to be negative determinants, statistically significant at the 1% level. However, *CCPB* exhibits a positive relationship, statistically significant at the 5% level. Both *WAGE* and *COASTAL* are statistically insignificant, but respectively exhibit a negative and a positive relationship.

With respect to *GPP*, as presented in Table 11, the empirical result shows that the gross provincial product has a positive and a significant impact on regional FDI in China at the 1% significance level for all model specifications. It means more amount of gross provincial product will raise more amount of FDI in a region because larger economies have more market demand. This conclusion conforms to previous expectations. Coughlin and Segev (2000) and many other empirical studies also find such positive relationship.[75] In addition, this paper also finds *PER* is a positive and significant variable for regional FDI in China at the 1% significance level. Such conclusion represents that more amount of *PER* of a region will improve the amount of FDI in a region. *HIWAY* is also a positive determinant of FDI. That is to say, a region's infrastructure has a positive relationship with FDI, statistically significant at the 1% level. This conclusion is consistent with previous studies. Coughlin et al. (1991), Head and Ries (1996) and Broadman and Sun (1997) also found that transportation infrastructure has a positive and a significant relationship with FDI. In addition, *AFDI* represents agglomeration effect which has a positive impact on FDI at a 1% significant level. However, the result does not conform to Sun et al. (2002),[76] but it is consistent with Heid and Ries (1996) and Cheng and Kwan (1999).[77]

[75] Kravis and Lipsey (1982) and Broadman and Sun (1997) also found GPP to be a positive, statistically significant determinant of FDI in China.

[76] Sun et al. (2002) found that a 1% increase in CFDI/CINV leads to a 0.30% *decrease* in FDI. This seems to suggest that FDI cannot create a "herding effect". The more FDI accumulated relative to the domestic investment accumulated, the less FDI to come.

[77] Heid and Ries (1996) and Cheng and Kwan (1999) found support evidence for the agglomeration

Table 7：Estimation Results of Regression Model

| Variables | Coefficient | | t-value | |
|---|---|---|---|---|
| *CONSTANT* | -10.3456 | *** | -4.545 | |
| log *GPP* | 0.9874 | *** | 18.922 | |
| log *PER* | 0.9582 | *** | 6.888 | |
| log *WAGE* | -0.3010 | | -0.991 | |
| *HIWAY* | 1.3385 | *** | 4.058 | |
| *OP* | -0.1465 | *** | -3.336 | |
| *AFDI* | 0.6224 | *** | 9.525 | |
| *CCPB* | 0.3916 | ** | 2.378 | |
| $CCPB \times T$ | -0.1498 | *** | -4.184 | |
| *COASTAL* | 0.1160 | | 1.118 | |
| *Y*99 | -0.2434 | | -1.790 | |
| *Y*00 | -0.3027 | | -2.055 | |
| *Y*01 | -0.2501 | | -1.504 | |
| *Y*02 | -0.2702 | | -1.305 | |
| *Y*03 | -0.5021 | | -2.059 | |
| *Y*04 | -0.1281 | | -0.492 | |
| *Y*05 | -0.1643 | | -0.620 | |
| *Y*06 | -0.8892 | | -0.281 | |
| Sample Size | | | 270 | |
| Adjust $R^2$ | | | 0.8682 | |
| One Way: F-Statistic | | | 105.24 | *** |
| B-P Statistic: $\chi^2$ | | | 133.66 | |
| LM Test | | | 0.9512 | |
| RESET Test | | | 0.7723 | |

Notes: 1. Symbols ***, **and * denote that null hypothesis of estimated parameter equal to zero is rejected at 1%, 5%and 10% significance level.

2. Dependent variable is the amount of foreign direct investment.

3. The results of regression model are corrected for heteroskedasticity by White (1980).

effect of FDI in China.

Most of all, *CCPB* is a positive variable but significant at the 5% significance level. It shows that the index of provincial political power in the Central Committee of the Chinese Communist Party or the Central Political and Legislative Affairs Committee does influence FDI positively which means higher degree of region's political power in the central government raising more amount of FDI. It is because the provinces with higher degree of political power acquire preferential policy earlier than those with lower degree of region's political power. It is exactly consistent with the expectation of this paper.

Aside from positive determinants of FDI, *OP* and $CCPB \times T$ represent negative variables, statistically significant at the 1% level, as presented in Table 11. *OP* is especially surprising to our expectation. The degree of openness has mixed blessings on FDI. On the one hand, a more open economy attracts FDI because it welcomes more foreign capital. In addition, foreign investors are more familiar with the host economy.[78] But on the other hand, openness can have a negative impact on FDI due to keen competition.[79] This result conforms to Wheeler and Mody (1992) that *OP* has a negative impact on FDI which means higher degree of openness does not improve the amount of FDI in China after 1997. It is because some countries are recipients of import-substituting investment, attracted by high trade barriers.[80] As referred to $CCPB \times T$, according to Figure 4, *CCPB* has a negative impact on *Time Trend*. Region's political power in the central government of China decreased after 2 years. However, *WAGE*, *COASTAL* and *TIME TREND* are insignificant.

[78] Edwards (1990) found supporting evidence that the degree of openness has a positive impact on FDI.
[79] Wheeler and Mody (1992) found that Brazil and Mexico attracted major US investment in their sample period despite these two countries have very low ratings in openness.
[80] According to Wheeler and Mody (1992), the degree of openness of the economy includes 9 measures of government intervention which are import restrictions, export requirements, local content requirements , price controls, profit repatriation controls, exchange controls, foreign equity limitations for existing and new investment, and the risk of expropriation.

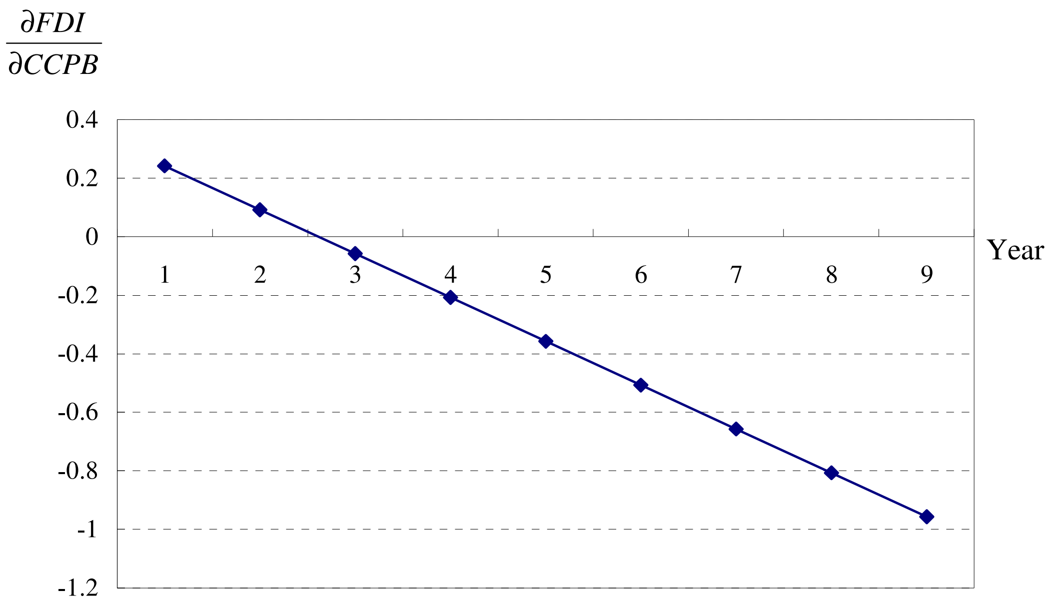


Figure 4：Trend of Political Power

## 5.2 Specification Tests

According to Table 11, the RESET test provides strong evidence that the results indicate in this paper do not have model misspecifications.[81] In addition, since all specifications are found to have a heteroskedasticity problem (the $\chi^2$ statistics based on the Breusch-Pagan test all reject the critical value in $\alpha$=0.01), the corrected covariance matrix proposed by White (1980) is used instead.[82] The *F*-statistics in the model rejects the null hypothesis which assumes that the coefficients are all zero at $\alpha$=0.01. In addition, Lagrange Multiplier test (LM test) expresses there is no autocorrelation problem in this paper. Based upon these tests for econometric issues, such as model misspecification, autocorrelation, heteroskedasticity and multicollinearity, it is implied that the conclusions provided by this paper are reliable.

### 5.2.1 Testing for Model Mutilcollinearity

Many variables may move together in systematic ways. Such variables are known as collinear variables. The problem of collinearity would lead to incorrect conclusions which are called collinearity or multicollinearity. Multicollinearity is a common problem in the analysis of the regression method. A simple test for multicollinearity is to look at the correlation coefficients among explanatory variables. All of the explanatory variables do not exceed 0.85 in the model. Therefore, this paper can claim the conclusion that there is no multicollivearity occurring in this paper. From the regression and the correlation coefficients, this paper can draw the conclusion that multicollinearity is not a problem.

---

[81] In order to test the hypothesis of model misspecifications, the RESET (Regression Specification Error Test) test is adopted and the results indicate that the models in this paper do not have this problem. Finally, none of the pairwise correlation coefficients are greater than 0.85 and it is thus concluded that there is no multicollinearity in the empirical models.

[82] In fact, the usual set of OLS results is given, but with a revised robust covariance matrix.

### 5.2.2 Testing for Model Autocorrelation: Lagrange Multiplier Test

When using panel data, this paper needs to consider the existence of autocorrelation. If this paper neglects the problem of autocorrelation, the result may be overestimated or underestimated. Furthermore, it could influence the accuracy of interval estimation and hypothesis test. This paper adopts Lagrange Multiplier test (LM test) to examine the autocorrelation problem. First, this paper makes the residual error of the empirical model follow first stage of autocorrelation model presented as follows:

$$\varepsilon_{it} = \rho\varepsilon_{i(t-1)} + v_{it} \tag{5-1}$$

Second, this paper assumes that $v_{it}$ is normally distributed and also satisfies the general assumption of an independent and identical distribution (iid). If $\rho = 0$, then $\varepsilon_{it}$ is equal to $v_{it}$. Thus, equation (5-1) is not auto correlated. The empirical model can be corrected to equation (5-2).

$$\log FDI_{it} = \beta_{0i} + \sum_{k=1}^{K} \beta_k X_{kit} + \rho\varepsilon_{i(t-1)} + v_{it} \tag{5-2}$$

If $\varepsilon_{i(t-1)}$ can be observed, then a test of $H_0 : \rho = 0$ is a way to examine the significance of $\rho$ by using the regression model of $\log FDI_{it}$ to $X_{kit}$ and $\varepsilon_{i(t-1)}$. However, if $\varepsilon_{i(t-1)}$ can not be observed, we substitute for $\hat{\varepsilon}_{i(t-1)}$. The LM test results indicate that its corresponding *p*-value of 0.9512 is well above the conventional significance level of 0.1. The lack of significance of the LM statistic suggests that the model which is adopted in this paper is not auto correlated.

### 5.2.3 Testing for Model Heteroskedasticity: Breusch Pagan Test

In statistics, the Breusch-Pagan test is used to test for heteroskedasticity in a linear regression model. Breusch and Pagan have devised a Lagrange multiplier test of the hypothesis that $\sigma_i^2 = \sigma^2 f\left(\alpha_0 + \alpha' z_i\right)$, where $z_i$ is a vector of independent variables. This test can be applied to a variety of models. Under normality, this modified statistic will have the same asymptotic distribution as the Breusch Pagan statistic, but in the absence of normality, there is some evidence that it provides a more powerful test. In this paper, the chi-square of Model is 133.6632. The chi-square of the Model exceeds $\chi^2_{0.05,17} = 28.8693$. Therefore, this paper asserts that there is heteroskedasticity in the Model. White's correction constructed by White (1981) has been used for correcting heteroskedasticity in the Model.

### 5.2.4 Testing for Model Misspecification: The RESET Test

To test model misspecification, this paper adopts the RESET test. The RESET test (Regression Specification Error Test) is designed to detect omitted variables and incorrect functional form. It examines whether the functional form of models suffered from misspecification errors and omitted variable bias. Moreover, it also is a general test for the correlation between independent variables and the error terms caused by measurement error in the independent variables, simultaneity considerations, or the combination of a lagged dependent variable with autocorrelated error terms.

RESET is computed by regressing the residuals on the independent variables and the square of the fitted dependent variable. It proceeds as follows. First, let the predicted values of the $FDI$ be

$$\log \hat{FDI} = \beta_{0i} + \sum_{k=1}^{K} \beta_k X_{kit} \qquad (5\text{-}3)$$

where $k$ represents the $k^{'}$th explanatory variables, $i$ and $t$ represent respectively $i^{'}$th province and $t^{'}$th year. Further, add the predicted values of $FDI$ to the regression model:

$$\log \hat{FDI} = \beta_{0i} + \sum_{k=1}^{K} \beta_k X_{kit} + \gamma_1 \log \hat{FDI}_{it}^{2} + \varepsilon_{it} \qquad (5\text{-}4)$$

In equation (5-4), a test for misspecification is a test of $H_0 : \gamma_1 = 0$ against the alternative hypothesis, $H_1 : \gamma_1 \neq 0$.

Rejection of $H_0$ implies that the original model is inadequate and can be improved. A failure to reject $H_0$ implies that the test has not been able to detect any misspecifications. Overall, the general philosophy of the test is: if this paper can significantly improve the model by artificially including powers of the predictions of the model, then the original model must have been inadequate. Adding squares of the $FDI$ predictions to estimate models, the RESET test results indicate that its corresponding *p*-value of 0.7723 is well above the conventional significance level of 0.1. There is insufficient evidence from the RESET test to suggest that the models are inadequate. The lack of significance of the RESET statistic suggests that the models which are adopted in this paper are appropriate.