Assessment of the Impact of the Beijing-Tianjin-Hebei Coordinated Development Strategy on Economic Development - An Empirical Analysis Based on the Difference-in-differences Model

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Abstract. In recent years, the coordinated development strategy of the Beijing-Tianjin-Hebei region, as an integral component of China's national strategy, has garnered significant attention. However, there remains a lack of comprehensive understanding regarding its actual impact on economic development. This paper aims to utilize a doubly-difference model to delve into the influence of the BTH coordinated development strategy on economic growth and provide insights for relevant policy formulation. Leveraging abundant regional economic data, this study employs a doubly-difference model for empirical analysis, systematically evaluating the strategy's impact on economic development from both temporal and spatial perspectives. The research reveals that following the implementation of the BTH coordinated development strategy, notable trends in regional economic development emerge. These trends include a significant increase in per capita GDP, a gradual optimization of industrial structure, and a positive shift in overall economic development indicators. In summary, the findings suggest that the BTH coordinated development strategy has played a constructive role in promoting economic growth, albeit requiring further refinement and deepening. This study contributes to a deeper understanding of the practical effects of China's regional coordinated development strategy, offering valuable insights for policymaking considerations.

Keywords: Coordinated development of the Beijing-Tianjin-Hebei region, Per Capita GDP, industrial upgrading.

1. Introduction

Located at Circum-Bohai Sea Region, Beijing-Tianjin-Hebei region, which full title is Beijing-Tianjin-Hebei Coordinated Development of Urban Agglomeration. This agglomeration's stated boundaries include Beijing, Tianjin, and eleven prefecture-level cities in the province of Hebei, including Zhangjiakou, Tangshan and others. Beijing, the capital of China, as the center of politics and culture, combining with the open coastal city Tianjin and populous province Hebei, has been gathering large number of resources and best talent. The formation of BTH Urban Agglomeration under BTH Coordinated Development policy, without doubt, has played a vital role in economic development in China. Based on data from China's National Bureau of Statistics for the year 2018, the gross value of production of BTH Urban Agglomeration is 3639.32 billion yuan, which accounts for roughly 8.56% of the whole country's [1].

The fundamental tenet of BTH Coordinated Development policy is viewing Beijing, Tianjin, and Hebei to accomplish the goal of coordinated development. By bringing non-capital cities' advantages superiority into full play, Beijing's "big city malaise" can be avoided and the urban layout can be adjusted in a more reasonable way. As other consequences, modern transportation networks were built, public services were shared, speed of integration process was rapider and modern capital-circle was perfected step by step. In recent decades, BTH Coordinated Development policy has obtained

some achievements in many fields. The non-capital functions of Beijing have been orderly relocated, the spatial development of BTH urban agglomeration has been constantly being optimized, transportation integration construction including the expansion of the interconnected railway and highway network has been completed gradually, the overall economic strength has continued to grow, people's living environment has improved, and per capital GDP for this region has continued to rise. In 2023, the BTH region continues to implement plans for coordinated development and has launched innovative initiatives such as the "Free Trade Pilot Zone" and so on.

2. Institutional Background and Research Hypotheses

At present, researches on the Strategy of BTH Coordinated Development and economic development mainly used randomized trials and quasi-experiments to evaluate the effect of policy implementation in various aspects. Due to the difficulty in implementing randomized trials, quasi-experimental methods, represented by the double difference method, are used more widely. However, due to the different data interception period, variable design and policy evaluation indicators, the conclusions of existing studies on whether the policy promotes the coordinated development of regional economy also vary from person to person. Liu Yucheng et al. believed that although the overall output level of the Beijing-Tianjin-Hebei region was higher than the national average, there were still problems such as huge development gap within the region, unreasonable urban system, backward economic ties, and function division, etc. Therefore, the Strategy of BTH Coordinated Development had not significantly promoted the economic development of the covered region [2]. Ma Jinyi extracted panel data on urban economy from 2000 to 2018 to evaluate the current economic development status of the Beijing-Tianjin-Hebei region. She believed that the integration of Beijing Tianjin Hebei had a promoting effect on the overall economic growth of Beijing-Tianjin-Hebei, Beijing, and Tianjin, but had not achieved the expected effect on Hebei [3]. However, Wei Liying said that the Strategy of Beijing-Tianjin-Hebei Coordinated Development restrained the economic development of Beijing and Tianjin to the greatest extent, and speeded up the economic development of Hebei Province to the greatest extent [4]. On the contrary, Zhao, X., Zhou, W., & Lu, J. believe that the economic disparities between Beijing and Tianjin are narrowing, while the economic gap with Hebei Province is widening [5]. Bai Yingchen contends that the actual effects of the BTH coordinated development strategy on promoting regional economic growth are not significant, necessitating further policy adjustments and optimizations to achieve the desired objectives [6]. It is worth noting that some studies have pointed out that the coordinated development strategy of the Beijing-Tianjin-Hebei region, by concentrating and integrating regional resources and implementing rational allocation, has a significantly effective impact on the regional economy. The policy effect is worthy of recognition [7].

The 28-31 provinces (autonomous areas, municipalities directly under the central government) that are not part of the Beijing–Tianjin–Hebei region are typically used as the control group by most researchers. This method, however, ignores other unreported policy elements, such as additional national-level initiatives akin to the BTH coordinated development strategy. Therefore, this study primarily employs the double difference method based on the findings of the research. The control group consists of fifteen provinces: Guangdong, Guangxi, Shaanxi, Qinghai, Xinjiang, Gansu, Shanxi, Ningxia, Henan Liaoning, Jilin, Heilongjiang, Inner Mongolia, Fujian, Shandong, Guangdong, Guangxi, Shaanxi, Gansu, and Xinjiang. The implementation of the BTH coordinated development plan is concentrated on assessing changes in the industrial structure and per capita GDP within the policy coverage area, both from a temporal and spatial perspective. In summary, the following research hypotheses are advanced:

According to the Agglomeration Effect Theory, the integration and rational allocation of resources between regions can promote industrial agglomeration and economic growth, thereby elevating the economic development level of the regions. Thus, the implementation of the BTH Coordinated Development Strategy is expected to significantly enhance the economic development level of the

covered regions by optimizing resource allocation and promoting industrial agglomeration. Thus, hypothesis 1 is proposed in this paper.

H1: The adoption of the Strategy of Beijing-Tianjin-Hebei Coordinated Development will significantly improve the economic development level of the covered regions.

Regional Economic Integration Theory posits that through promoting inter-regional economic integration and coordinated development, complementary resource advantages, market expansion, and efficiency improvement can be achieved, thereby driving regional economic development. Therefore, the application of the BTH Coordinated Development Strategy contributes to strengthening the economic integration of the covered regions, thus enhancing economic development levels. With the support of Regional Economic Integration Theory, the hypothesis 2 is presented in this paper.

H2: The industrial structure of the policy-affected region will be gradually optimized following the execution of the Beijing-Tianjin-Hebei Coordinated Development Strategy, the degree of opening will show a positive trend, the education level will also be improved, personnel training will be accelerated, and economic development will be further promoted. At the same time, the level of financial development has been significantly improved, and the level of economic development tends to be high-quality.

3. Research Design

3.1. Model Design

$$Y_{it} = \alpha + \beta\, treat_i * post_t + \gamma \cdot X_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

The above is the double difference model used in this paper. Where Y_{it} is the explained variable "economic development", $treat_i * post_t$ is the explanatory variable "Coordinated Development Strategy of the Beijing-Tianjin-Hebei Region", X_{it} is the control variables " Government Size, Urbanization Rate, Human Capital, Industry Structure", α is an intercept term indicating the baseline level of economic development when other variables are zero. $treat_i$ is the regional dummy variable that is 1 if the district has implemented the strategy and 0 otherwise. $post_t$ is the time dummy variable that is 1 if t≥2014, and 0 otherwise. μ_i is representing the regional fixed effects, ν_t is for time fixed effects, ε_{it} is the regression disturbance. The focus of this paper is to test the impact of the BTH Coordinated Development Strategy on economic development, and therefore focuses on the β, the cross-term coefficients. If β is positive and significant, then it indicates that the implementation of the BTH Coordinated Development Strategy has had a positive impact on economic development.

3.2. Selection of Variables and Descriptive Statistics

Explained variable: GDP per capita is used to calculate Economic Development (Y_{it}), a measure of the degree of economic development in the treatment group and the control group, expressed as the logarithm of GDP per capita ($lnGDP_{it}$).

Explanatory variable: Coordinated Development Strategy of the Beijing-Tianjin-Hebei Region ($treat_i * post_t$), where the time dummy variable is set to 1 in 2014 and above to control the impact of time factors on economic development, and $treat_i$ is a regional dummy variable, taking 1 for the Beijing-Tianjin-Hebei region and 0 for other regions to control the impact of geographic factors.

Control variables: Government Size (Gov_{it}), Urbanization Rate ($Urban_{it}$), Human Capital (HC_{it}), Industry Structure ($Indus_{it}$), Corresponding to measurement indicators: Government expenditure as a percentage of regional GDP, urban population as a percentage of total population, number of local university graduates as a percentage of total population, value added of the tertiary industry as a percentage of GDP.

The primary variables' descriptive statistics are displayed in Table 1 below:

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev	Min	Max
lnGDP	288	9.689	1.041	6.218	11.625
Gov	288	0.259	0.131	0.092	0.758
Indus	288	45.26	10.458	29.7	83.8
Urban	288	0.615	0.137	0.3	0.936
HC	288	25.165	13.395	4.709	60.281

3.3. Data Source

The panel data used in this paper covers 11 prefecture-level cities in Hebei Province (Baoding, Shijiazhuang, Xingtai, Langfang, Qinhuangdao, Zhangjiakou, Handan, Beijing, Tangshan, Chengde, Hengshui, Cangzhou) as well as over 100 prefecture-level cities in 15 provinces (Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Fujian, Shandong, Henan, Guangdong, Guangxi, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang and so on). Taking 2005-2020 as the research interval, the panel data were intercepted from the China Urban Statistical Yearbook for empirical analysis.

The division of the treatment and control groups is shown in the table below:

3.4. Parallel Trend Test

This study conducted a parallel trend test for the five years prior to the implementation of the policy in 2014. The results show that the regression results for the five years before the policy implementation are all not significant. Therefore, it is concluded that there is a parallel trend between the treatment group and the control group, which leads to the performance of double difference analysis.

4. Empirical Analysis Results

Table 2. Empirical Analysis Results

Variable	Coef	Std. Err
DID	0.180***	2.95
HC	0.026***	6.77
Indus	-0.005	-1.56
Urban	4.318***	8.70
Gov	1.730***	5.51

In this section, the empirical analysis results are presented as above, based on the Difference-in-Differences (DID) model as shown in the Table 2, aimed at evaluating the impact of the Beijing-Tianjin-Hebei (BTH) Coordinated Development Strategy on regional economic development. The following is an overview of the regression coefficients, standard errors, and significance levels of key variables:

4.1. Core Explanatory Variables

According to Table 2, DID which stands for the product of treat and post., the coefficient of this variable is 0.1809786, with a standard error of 2.95, marked as significant at the *** level, indicating a significant positive impact of the coordinated development strategy in Jing-Jin-Ji on increasing per capita GDP at a 1% confidence level. This result supports the notion of the strategy's constructive role in promoting regional economic growth.

4.2. Control Variables

Human Capital (HC): At the 1% confidence level, the coefficient for human capital is 0.0264929, with a standard error of 6.77. It is also significant. This implies that a major factor propelling economic expansion is an increase in human capital.

Industrial Structure (Indus): The coefficient for industrial structure is -0.0058247, with a standard error of 1.56, failing to pass the significance test. This may imply that the adjustment of industrial structure does not have statistically significant effects on per capita GDP in the short term.

Urbanization Level (Urban): The coefficient for urbanization level is 4.318238, with a standard error of 8.70, significant at the *** level, indicating a significant positive effect of urbanization level on per capita GDP.

Government Size (Gov): The coefficient for government size is 1.730255, significant at the *** level, and has a standard error of 5.51. This indicates that government plays a positive impact in economic development.

The empirical analysis results reveal the positive impact of the BTH Coordinated Development Strategy on regional economic growth. Specifically, the increase in human capital and urbanization level is confirmed as key factors driving economic growth. Although the direct impact of optimizing industrial structure on per capita GDP is not statistically significant, this may point to the need for a longer-term perspective and deeper analysis to assess its potential economic effects.

5. Conclusion

5.1. Research Conclusion

The empirical analysis underscores the significant positive impact of the coordinated development strategy of the Beijing-Tianjin-Hebei region on regional economic growth, particularly evidenced by the substantial increase in per capita GDP. This strategy has proven effective in fostering economic development through various channels, including the enhancement of human capital and urbanization level. While the immediate effect of industrial structure optimization on per capita GDP is not statistically significant, it may indicate the need for a longer-term perspective to fully assess its economic ramifications.

5.2. Policy Recommendations

(1) Continued Support for Coordinated Development Strategy: Policymakers should continue to prioritize and invest in the coordinated development strategy of the Beijing-Tianjin-Hebei region, as it has demonstrated its effectiveness in promoting economic growth. This includes further integration of policies and resources across the region to leverage complementary advantages and spur sustainable development.

(2) Investment in Human Capital: Given the significant role of human capital in driving economic growth, efforts should be intensified to enhance education and skills training programs. This may involve increasing funding for education, promoting lifelong learning initiatives, and facilitating access to vocational training to ensure a skilled and adaptable workforce.

(3) Urbanization Policies: Urbanization has emerged as a key driver of economic growth. Therefore, urbanization policies should focus on improving infrastructure, expanding access to basic services, and creating conducive environments for businesses to thrive in urban areas. Additionally, measures should be implemented to address challenges related to urbanization, such as housing affordability and environmental sustainability.

(4) Long-Term Industrial Structure Planning: While the immediate impact of industrial structure optimization may not be apparent, policymakers should adopt a long-term perspective when planning and implementing industrial policies. This involves fostering innovation, promoting technological advancements, and supporting industries with high growth potential to ensure a resilient and diversified economy.

(5) Government Role in Economic Development: Recognizing the positive role of government size in economic growth, policymakers should strive to maintain an appropriate balance between market forces and government intervention. This includes streamlining administrative procedures, enhancing transparency and accountability, and ensuring efficient resource allocation to facilitate market development while safeguarding public welfare.

By adhering to these recommendations, policymakers can further bolster the economic growth momentum in the Beijing-Tianjin-Hebei region and contribute to the overall prosperity and sustainability of the area.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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