

A study on the impact of administrative division adjustment on regional economy based on synthetic control method

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Abstract. In recent times, the regional planning of Huizhou has been adjusted relatively frequently, from six counties in one province to Wuyuan and Jixi, until 1987, when Huizhou was renamed Huangshan City and Jixi was transferred to Xuancheng. Since then, "Huizhou" in the sense of administrative division has ceased to exist. To study the impact of this event on the regional economy, this paper compiles data from Jixi, Qimen, Yixian, Shexian, and Xuning counties since the founding of the country and uses a synthetic control method to empirically study the economic impact of the 1987 transfer of Xuancheng on Jixi. The results found that the economic development gap between Jixi and the other three counties was not significant before 1987, but after 1987, Jixi's economic development was significantly better than that of the other three counties, indicating that the 1987 administrative division promoted Jixi's economic development.

Keywords: Huizhou; Administrative division adjustment; Regional economy; Synthetic control method.

1. Introduction

Huizhou, a famous cultural and geographical concept in China, an independent and outstanding folk unit, Huizhou, a province of six counties including Jixi, She County, Xuning, Yixian, Qimen and Wuyuan, which is now assigned to Jiangxi, in this piece of land with an area of only 13,000 square kilometers, the ancient culture of the Central Plains and the local closed geographical environment and socio-economic life merged into one, forming a profound, unique and profound Huizhou culture. Huizhou culture is a regional culture with great local characteristics, and is one of the three major regional cultures in China.

In the third year of Xuanhe of Emperor Huizong of Song Dynasty (1121 AD), Shezhou was changed to Huizhou. In the following 866 years, these six counties have been steadily subordinated to Huizhou, which is extremely rare in the history of Chinese political regions. In the first year of the Republic of China (1912), the prefecture was abolished and the county was directly under Anhui Province. In the twenty-third year of the Republic of China (1934), Wuyuan was assigned to Jiangxi province, and in the thirty-sixth year of the Republic of China (1947), due to the continuous resistance of the people of Wuyuan and the strong demand of the people of other counties in Huizhou, Wuyuan county was reassigned to Anhui province. 1949, due to the need of liberation, Wuyuan was assigned to Jiangxi province from then on. 1983, Huangshan township of She county, Guangyang township of Shitai county and Taiping county were assigned to establish Huangshan city (county level), which was administered by the province. In 1987, Huizhou region was renamed as Huangshan city, and Jixi county was transferred to Xuancheng region. Today Huizhou is divided into Anhui and Jiangxi provinces, and split into Huangshan City, Jixi County (Xuancheng City) and Wuyuan County (Shangrao City). The administrative division of ancient Huizhou has undergone fundamental changes [1-3].

There is a good foundation for domestic research on administrative division and regional economy, but it is more focused on the analysis of its history, current situation and formation causes, and lacks quantitative analysis. Moreover, the existing analyses are mainly focused on big cities, and there is a lack of research on the adjustment of administrative divisions in Huizhou and even at the county level. In view of this, this paper intends to make a breakthrough from the above two aspects and select six

counties in ancient Huizhou to study the impact of administrative division adjustment on regional economy.

2. Model Design

In the evaluation of policy effects, the SyntheticControlMethods proposed by Abadie et al. (2003) is popular among scholars at home and abroad. This method uses a weighted average of reference groups to construct a "counterfactual" reference group for each individual policy intervention, i.e., a synthetic control object, to simulate the economic development of Jixi without the district division policy, and to compare the effects of the policy implementation [4].

Assuming that $N+1$ regions are observed, the first region (here Jixi), is divided from Huizhou to Xuancheng (1987) in period T_0 , and the other N regions are not divided as a potential control group, and the time interval is $[1, T]$, where $1 \leq T_0 < T$ indicates the potential outcome of region Y_{it1} at moment t after being affected by the policy of division from Huizhou to Xuancheng, and Y_{it0} indicates the potential outcome of region i without the division from Huizhou to Xuancheng at time t , where $i=1, \dots, N+1$ and $t=1, \dots, T$. Then the observed outcome of region i at period t should be.

$$Y_{it} = D_{it}Y_{it}^1 + (1 - D_{it})Y_{it}^0 = Y_{it}^0 + \tau_{it}D_{it} \quad (1)$$

The potential outcome can be observed to obtain the true outcome, but the potential outcome when no policy intervention is delineated cannot be directly observed, so model estimates are used.

$$Y_{it}^0 = \delta_t + \theta_t Z_i + \lambda_t \mu_i + \varepsilon_{it} \quad (2)$$

To further estimate, the synthetic control method is used to construct a weight vector W of synthetic controls. each given weight taken for vector W represents a weighted average of the potential control group areas for area 1, i.e., a feasible synthetic control combination. The result of the synthetic The result of the synthetic control can be written as.

$$\sum_{j=2}^{N+1} w_j Y_{jt} = \delta_t + \theta_t \sum_{j=2}^{N+1} w_j Z_j + \lambda_t \sum_{j=2}^{N+1} w_j \mu_j + \sum_{j=2}^{N+1} w_j \varepsilon_{jt} \quad (3)$$

Assume that there exists a weight vector W^* that satisfies for any $1 \leq t \leq T_0$.

$$\sum_{j=2}^{N+1} w_j^* Y_{jt} = Y_{1t}, \text{ and } \sum_{j=2}^{N+1} w_j^* Z_j = Z_1 \quad (4)$$

Then if the matrix is a non-singular matrix, then.

$$Y_{1t}^0 - \sum_{j=2}^{N+1} w_j^* Y_{jt} = \sum_{j=2}^{N+1} w_j^* \sum_{s=1}^{T_0} \lambda_s \left(\sum_{n=1}^{T_0} \lambda_n' \lambda_n \right)^{-1} \lambda_s' (\varepsilon_{js} - \varepsilon_{1s}) - \sum_{j=2}^{N+1} w_j^* (\varepsilon_{jt} - \varepsilon_{1t}) \quad (5)$$

It can be shown that the above equation tends to 0 under general conditions, thus yielding an estimate of the effect of dividing the policy.

$$\hat{\tau}_{1t} = Y_{1t} - \sum_{j=2}^{N+1} w_j^* Y_{jt} \quad (6)$$

After the synthetic control model results are calculated, a placebo test is required to demonstrate the validity of the results. Usually Abadie et al. (2010) proposed a method similar to the "Permutation Test" in statistics to perform statistical test. The idea is to use each area in the reference group in turn as a hypothetical treatment area (i.e., assuming that it was also assigned to Xuancheng in 1987). The idea is to treat each region in the reference group in turn as a hypothetical treatment region (i.e., the hypothetical Xuancheng region was also allocated in 1987) and the original treatment region (Jixi) as a control region, and then estimate its policy effect using a synthetic control method, also known as the "placebo effect. This is also known as the "placebo effect". The distribution of the placebo effect is obtained through a series of placebo tests, which are compared with the treatment effect of the original treatment group. The treatment effect is compared with the treatment effect in the original treatment group to see if the treatment effect is significantly better than the "placebo effect."

3. Historical analysis of the regional development of Shexian, Yixian, Xuning, Qixi and Jixi counties

Due to the long history of the study and the niche of the research population, the missing data were more serious. After a comprehensive comparison, the per capita industrial and agricultural output value was finally selected as the explanatory variable to describe the economic development of Jixi, and the per capita fiscal revenue, per capita fiscal expenditure, and year-end population were used as predictive control variables [5,6].

3.1 Population

In this paper, the year-end population figures of five counties, She County, Yixian County, Xuning, Qimen and Jixi, were selected for mapping from 1949 to 2005. As shown in Figure 1.

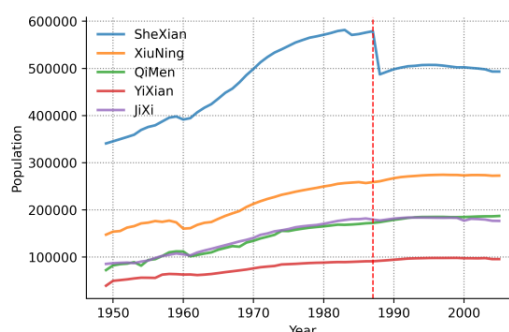


Figure 1 Five counties year-end people

From the figure, it is easy to find that the population changes in Jixi are highly similar to those in Xuning and Qimen, while the population of She County decreases sharply after 1987. Therefore, Jixi, Xuning, Qimen, and Yixian counties are selected for the next analysis in this paper.

3.2 Agriculture

Huizhou area has superior natural conditions and rich agricultural and forestry resources, and the economy in the territory has always been mainly agricultural, including tea and forestry production in the northern mountainous area, and rice, rape and other grain and oil crops in the southern Fanzhou area. It is a comprehensive agricultural mountainous area with forestry and tea as the main business and multiple operations. Due to the serious lack of data in She County, the per capita agricultural output value of Jixi, Qimen, Yixian and Xuning counties from 1949 to 2005 (at constant 1990 prices) was selected for analysis[7].

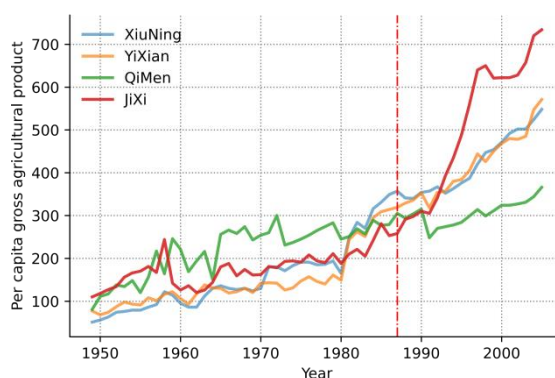


Figure 2 Total agricultural production per capita in the four counties

From Figure 2, we can see that the trend of agricultural output per capita in Jixi, Xuning, Yixian, and Qimen counties is similar, fluctuating but generally upward, and after 1990, there is a significant increase in agricultural output per capita in Jixi County.

3.3 Industry

Huizhou is located in the mountainous area of southern Anhui, and modern industry started late. From the Qing Dynasty to the Republic of China, there were only some handicraftsmen and handicraft workshops scattered between cities and villages, serving production and people's life[8]. After the founding of New China, successive governments attached importance to the development of industry, and through the socialist transformation of private industry and handicrafts, the establishment of handicraft cooperatives and local public-private partnerships, and the increase of industrial investment, modern industry has developed to a certain extent, but given the constraints of production conditions, industrial development has been slow. In the 1990s, the government actively implemented the development strategy of "industrial enrichment" in order to highlight the leading position of industry. At the same time, the government actively carried out the reform of the enterprise system, increased investment attraction, and vigorously developed the individual and private economy, and a large number of industrial projects were completed and put into operation, which made the regional industry develop significantly [9].

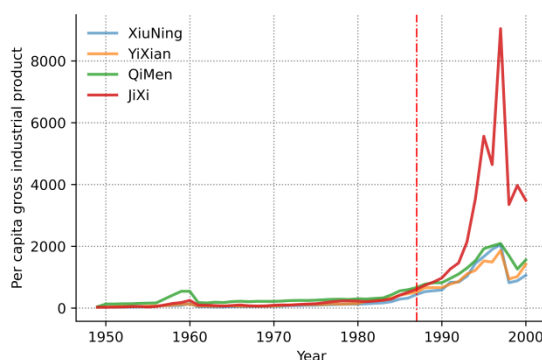


Figure 3 Total industrial output per capita in the four counties

Total industrial output per capita in the four counties is shown in Figure 3. From the data collected, we can see that the industrial development in Xuning, Yixian, and Qimen counties was relatively similar, while Jixi experienced a more rapid development after 1987 and reached its peak in 1997. Combined with historical data, in the winter of 1985, the State Council approved the unification of Shanghai's "small third-line" enterprises (built from 1966 to 1972) in Jixi. In the early 1990s, Jixi also used the "three reforms" (labor, personnel system, and distribution system) as a breakthrough in

converting its business mechanism to improve the economic efficiency of its enterprises. Since the mid-1990s, the breakthrough was to "reorganize property rights and revitalize stock assets". Since the mid-1990s, the breakthrough was to "reorganize property rights and revitalize stock assets".

3.4 Financial Receipt

Revenues are a combination of all the funds that a government raises to carry out its functions, implement public policy and provide public goods and services. It is an important indicator to measure the financial strength of the government. After the founding of the People's Republic of China, the main revenue items of the five counties in ancient Huizhou were agricultural tax, industrial and commercial tax, enterprise income and other income. Since then, fund budget revenue and extrabudgetary revenue have been gradually added. As can be seen in Figure 4, the per capita fiscal revenue of the five counties has changed similarly, and with the sustained and stable economic development of each county, the fiscal revenue has increased year by year.

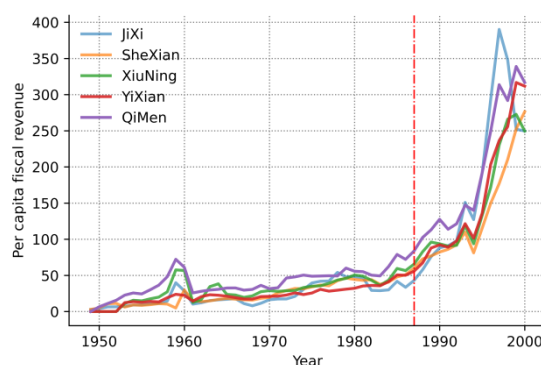


Figure 4 Per capita financial income of the five counties

3.5 Financial support out

Fiscal expenditures are the disposition and use of social resources, expressed in monetary terms, that are pooled by the government in the private sector to carry out its own functions. Fiscal expenditure is an important aspect of the government's distribution activities, and the influence of finance on social economy is mainly realized through fiscal expenditure.

During the period of the Republic of China, the financial expenditures of Huizhou mainly included administrative, cultural and educational, economic construction, health, social and relief, retirement and pension, defense, finance, general reserve and other expenditures and temporary expenditures, among which the defense expenditures accounted for the largest proportion of all expenditures. After the founding of the country, according to the unified fiscal system, most of the local revenues were transferred to the provinces and the central government, and the part reserved for the local government plus the part allocated to the local government by the central government and the provinces was used as local budgetary expenditure, mainly for economic construction and the development of various social undertakings such as culture, education and health, as well as the improvement of people's life, and a small part was used for administrative expenses. In the 1990s, the finance department adhered to the management method of "setting revenues and expenditures, balancing revenues and expenditures, and leaving a small balance", actively carried out the reform of the financial system, strengthened the management of financial revenues and expenditures, effectively organized revenues, controlled administrative expenditures, and used limited financial resources for economic construction and social undertakings to maximize the effectiveness of funds. In addition to the fiscal expenditure to the provincial and central government, the key expenditure items are economic construction funds, cultural, educational, health and vocational fees, agriculture, forestry and water fees, compassionate and social welfare fees, administrative fees and other main expenses, etc.[10].

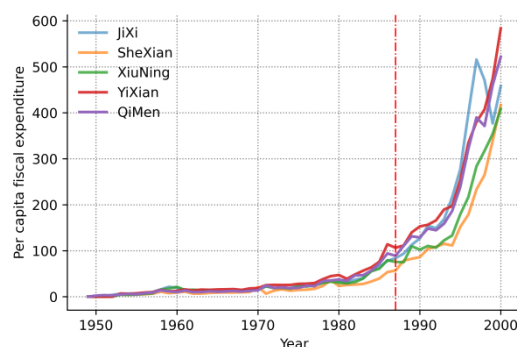


Figure 5 Per capita financial expenditure in five counties

Figure 5 shows the per capita fiscal expenditures of each county since 1949, and it can be seen that the expenditures are roughly the same as the revenues. This is partly due to the rapid development of the local economy, and partly due to the local management approach of "income and expenditure, balanced income and expenditure, and a small balance.

Taking into account the problems of population migration, regional division, and missing data for She County, this paper uses Jixi as the treatment group and Xuning, Yixian, and Qimen counties as the reference group to observe the impact of the 1987 Xuancheng administration on the economic development of Jixi using the synthetic control method.

3.6 Empirical Analysis

Based on the previous synthetic control model, this paper uses per capita industrial and agricultural output value as the predicted variable and per capita fiscal expenditure, per capita fiscal revenue, and year-end population of each county as predictor variables in the process of analyzing the impact of the 1987 division policy on Jixi's economic development. First, based on the minimization distance function $\|X_1 - X_0W\|$, determine the weight W for each county, where X_1 represents the (3×1) -dimensional feature vector of Jixi County before 1987, X_0 is a (3×3) -dimensional matrix, and each column represents the corresponding feature vector of the remaining three counties before 1987. From the calculation results in Table 1, it can be seen that the weight of Yixian County is 0. Analyzing the reason, on the one hand, it may be due to the fact that the data of Yixian County are more different from Qimen and Huining than Jixi, on the other hand, the features of Yixian County may be closer to Qimen and Huining and can be replaced by the other two counties when synthesized. Therefore, this paper then uses the weighted average of the indicators of Qimen and Xuning counties as a proxy for synthesizing Jixi.

Table 1 Weighting of counties in synthetic Jixi

County Name	Weights
Qimen	0.29
Yixian County	0
Xuning	0.71

Weighting of counties in synthetic Jixi is shown in Table 1. For a preliminary examination of the predictive effect, the proximity of the predictive variables of Jixi and synthetic Jixi was observed.

Table 2 Predicted variable mean

Variables	Jixi Real	Jixi Synthesis	Average value of the remaining three counties
Population	165434.4	217544.4	186326.6
Fiscal revenue per capita	34.49412	43.77506	48.30392
Per capita financial expenditure	33.42353	33.60365	35.10589

As can be seen from Table 2, the predictor variables for both Jixi and synthetic Jixi are very close, except for population, and both are significantly better than the mean values for the other three counties. The model's RMSPE (Root Mean Squared Prediction Error) is 33.76962, which is a fair performance of the model.

The per capita agricultural and industrial output value of Jixi and the corresponding synthetic control from 1970 to 2000 is shown in the figure below, where the vertical dashed line indicates the year in which Jixi was transferred to Xuancheng. On the left side of the dashed line, the per capita agricultural and industrial output values of Jixi and its synthetic control city are very close to each other with minimal differences, indicating that synthetic Jixi fits the path of change in the per capita agricultural and industrial output value of Jixi very well. The difference between the two is the effect of the policy of Xuancheng on Jixi's economic development in 1987, indicating that the division of Jixi from Huizhou led to a significant increase in Jixi's per capita agricultural and industrial output compared to the assumption that Jixi was still part of Huizhou, a "boosting effect This "incremental effect" suggests that the division of Xuancheng contributed to Jixi's economic development.

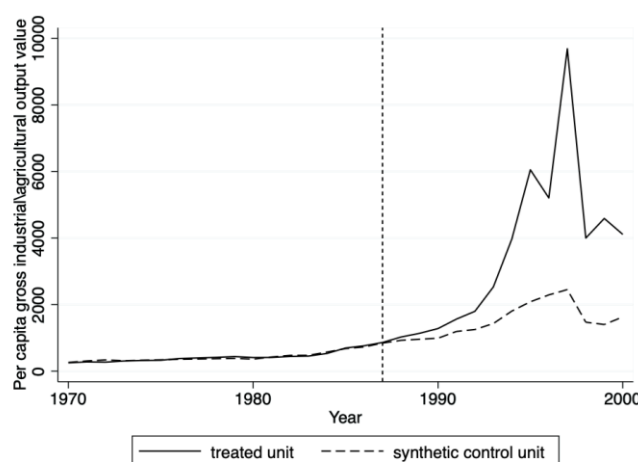


Figure 6 Agricultural output per capita in Jixi and synthetic Jixi

Agricultural output per capita in Jixi and synthetic Jixi is shown in Figure 6. The per capita agricultural and industrial output value of Jixi and the corresponding synthetic control from 1970 to 2000 is shown in the figure below, where the vertical dashed line indicates the year in which Jixi was transferred to Xuancheng. On the left side of the dashed line, the per capita agricultural and industrial output values of Jixi and its synthetic control city are very close to each other with minimal differences, indicating that synthetic Jixi fits the path of change in the per capita agricultural and industrial output value of Jixi very well. The difference between the two is the effect of the policy of Xuancheng on Jixi's economic development in 1987, indicating that the division of Jixi from Huizhou led to a significant increase in Jixi's per capita agricultural and industrial output compared to the assumption that Jixi was still part of Huizhou, a "boosting effect "indicates that the division of Xuancheng has contributed to the economic development of Jixi. What is the probability. Assuming that all of the reference counties were transferred to Xuancheng in 1987, we use the synthetic control method to construct control subjects for the corresponding cities, estimate the policy effects in the

hypothetical scenario, and then compare the actual policy effects in Jixi with the hypothetical policy effects in the control cities. If the difference in policy effects is large enough, then there is reason to believe that the policy effects of Xuancheng are significant.

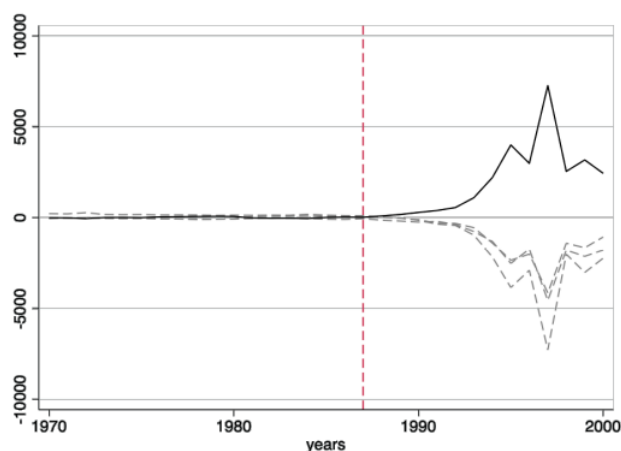


Figure 7 Distribution of the difference in industrial and agricultural output value per capita in the four counties

Figure 7 shows that the gap between Jixi and the other three counties in terms of per capita industrial and agricultural output value change was not large before 1987, but after 1987, the gap between Jixi and the other three counties began to widen and its distribution was above the other three counties, which indicates that the policy of transferring Xuancheng significantly improved Jixi's economic development, while at the same time, if the other three counties were divided out, there might be negative effects.

4. Conclusion

The per capita agricultural and industrial output values for Jixi and the corresponding synthetic control between 1970 and 2000 are shown in the figure below, where the vertical dashed line indicates the year in which Jixi was transferred to Xuancheng. On the left side of the dashed line, the per capita agricultural and industrial output values of Jixi and its synthetic control city are very close to each other with minimal differences, indicating that the synthetic Jixi fits the path of change in the per capita agricultural and industrial output value of Jixi very well. On the right side of the dashed line, the per capita agricultural and industrial output value of the synthetic control is significantly lower than that of Jixi, and the difference between the two is the effect of the policy of Xuancheng on the economic development of Jixi in 1987. "indicates that the division of Xuancheng contributed to the economic development of Jixi. What is the probability. Assuming that all of the reference counties were divided into Xuancheng in 1987, we use the synthetic control method to construct control subjects for the corresponding cities, estimate the policy effects in the hypothetical scenario, and then compare the actual policy effects in Jixi with the hypothetical policy effects in the control cities. If the difference in policy effects between the two is large enough, then there is reason to believe that the policy effect of deploying Xuancheng is significant. (Xuanzhou is closer and the region is more conveniently managed.) On the other hand, it may be that the allocation of resources is relatively more skewed due to the fact that Huangshan is under the jurisdiction of three districts and four counties, while Xuancheng is under the jurisdiction of one district and four counties.

With the release of the 2020 Hangzhou-Huang Huang World Class Natural Ecological and Cultural Tourism Corridor Construction Plan (Framework Draft), it is planned that during the 14th Five-Year Plan period (2021-2025), Anhui and Zhejiang provinces will make joint efforts to build "two cities and one county" (Hangzhou, Huangshan City and Jixi County of Xuancheng City). In the context of

world-class natural ecological and cultural tourism corridors in Hangzhou, Huangshan City and Jixi County of Xuancheng City, it is possible that there is no clear need for Jixi to return to Hui.

In terms of cultural affiliation, the Huizhou region has historically produced such celebrities as Zhu Xi, Dai Zhen, Wang Moyin, Hu Xueyan, Huang Binhong, Tao Xingchi, Hu Shi, Hu Zongxian, Hu Tianzhi, Hu Bingheng, etc. The affiliation of Jixi people to Huizhou culture is not contradictory to administrative division and economic development. As the old generation of Jixi sages and cultural figures continue to organize and spread Jixi Hui culture, culturally, Jixi people have never left Huizhou, never have in the past, and never will in the future.

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