

Study on the Effect of Liaoning Free Trade Area on Regional Economy*

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Abstract—In this paper, the monthly panel data of 31 provinces, municipalities and autonomous regions in China are used to evaluate the economic impact of Liaoning Free Trade area from the aspects of import and export of goods, economic growth and investment in fixed assets. By comparing the difference between the actual value of the economic variable before and after the establishment of the Free Trade area and the "counter-factual" estimate of the economic variable in the synthetic control area, this paper evaluates the policy impact of the establishment of the Free trade area. At the same time, according to the respective function orientation of the free trade area, this paper analyzes the difference influence of Liaoning free trade area on the economic index. The results show that the establishment of free trade area has a significant positive impact on export trade and economic growth to varying degrees, but it has no significant impact on import trade and fixed asset investment. The conclusion is of great significance for Liaoning Free Trade area to further improve the upgrading of free trade port.

Keywords—free trade area; synthetic control method; counter-factual analysis

I. INTRODUCTION

Liaoning Free Trade area was listed in April 2017, and the development of China free trade area formed a new pattern of "1+3+7" construction. Free trade area in Liaoning will be Dalian, Shenyang, Yingkou three cities into the planning scope, with a total area of about 120 square kilometers, among them, Dalian area account for 1 / 2 of the total area, Shenyang and Yingkou area account for 1 / 4 of the total area. Liaoning Free Trade Zone has been established and played a role for nearly a year. What is the effect of the free trade zone test, especially on the economy of Liaoning Province? This is the question this article will try to answer.

The research on the internal mechanism of the economic impact of the free trade experimental area is mainly focused on the following aspects: first, the innovation of the investment management system reduces the entry threshold of foreign investment and is conducive to the agglomeration of foreign investors, which promotes the absorption of foreign advanced technology and management experience, and improves the

*Fund projects: National Natural Science Foundation Project (71781330123); Liaoning Natural Science Foundation Project (201601006; 20170540041; 201801196); Liaoning Province Social Science Planning Fund (L15CJL002).

production efficiency of regional enterprises. Second, the innovation of the trade regulatory system has enhanced the degree of customs clearance and facilitation, improve the efficiency of the import and export system, reduce the administrative costs of enterprises, and is conducive to creating a relaxed and open trade environment, which increases the variety of trade in the region, expanding the volume of trade and bring about economies of scale. Third, the innovation of the administrative management system, government approval system and examination & approval system changed to a record system and a "negative list" management model, which has changed the pattern in which the government led the transformation and development of the economy in the past, and redefined the relationship between the government and the market. By deregulating and strengthening the power of market mechanism, the model stimulates market vitality and resource allocation efficiency, thus promoting economic growth. Fourth, the unprecedented opening of the business pattern attracts all kinds of enterprises to begin to attach themselves to the Free Trade area, bringing about the agglomeration effect, it forms the headquarters economy, the tax contribution effect, the chain investment effect, the industry multiplier effect, the consumption-driven effect, the labor employment effect and the urban "polarization-diffusion" effect and so on of the headquarters economy will greatly promote the development of the headquarters economy agglomeration city.(Yin Hua et al. (2017), Tan Na et al. (2015), Wang Lihui et al. (2017), Liu Binglian, Wang Yue, et al. (2018), Liu Binglian, Lu Cheng, et al. (2018), Huang Qicai, et al. (2018), Fan Ziyang, et al. (2018), Chen Yuting, Zhu Rui, et al. (2018), you Hong, Zou Hengfu et al. (2018)) [1-9].

At present, for the study of the economic effects of the free trade experimental area, scholars mostly carry out quantitative research on the Shanghai free trade area, such as Tan Na et al. (2015), Yin Hua et al. (2017), Wang Lihui et al. (2018), Nie Fei and so on (2018). Wang Xiaoling et al. (2018) and Xiang Houjun (2018) all found that the establishment of Shanghai free trade area had a positive effect on the local economy of Shanghai.[1][2][10]-[13]However, Shanghai has its own unique geographical location, continuous institutional and technological innovation, a high degree of opening to the outside world, and the historical precipitation of a hundred years of economic growth and so on, the conclusion that the establishment of free trade area will promote the economic growth of the established area is not enough to convince the

academic community. The innovation of this paper lies in the quantitative evaluation of the regional economic growth effect of the policy of Liaoning free trade experimental area, taking Liaoning free trade area as the research object at the same time. Due to the short time of the establishment of the last two free trade areas in China, there are relatively few researches on the second and the third free trade areas in the field of innovation and reform. In particular, the research results around Liaoning free trade area are still rare, and the existing studies have mainly focused on the feasibility analysis and strategic conception of the establishment of Liaoning free trade area, most of which are news reports, and the relevant theoretical research documents are relatively few, and quantitative research is more rare.

The structure of this paper is as follows: the first part is the introduction; the second part is the estimation method and the data description, including the data source, the data description and the concrete research and design method; the third part is the empirical result analysis and the robustness test; the fourth part is the conclusion.

II. ESTIMATION METHOD AND DATA DESCRIPTION

A. Estimation Method Selection

The commonly used policy effect assessment models in macroeconomic research include simultaneous equations model, vector autoregressive model (VAR) and dynamic stochastic general equilibrium model (DSGE), although these models are widely used in macroeconomic analysis, there are still many limitations. For example, it is difficult to distinguish between endogenous variables and exogenous variables by using simultaneous equations model, and VAR model is often criticized by Lucas. The DSGE model also depends on the complex model setting and computer programming ability.

In recent years, Difference in Differences, DID or (Propensity Score Matching, PSM are usually used to evaluate the policy effect. Economists began to draw lessons from the microcosmic experimental design, using the idea of controlled random experiments, using non-experimental methods such as tool variables, DID or matching, to construct "counter-fact" to carry out macroeconomic research. Among them, the Difference in Differences analysis requires the policy intervention group and the policy control group to meet the common trend hypothesis, and there is a certain subjective randomness to the object selection of the control group. The propensity score matching method should satisfy the conditional independence hypothesis, that is, the object selection of policy intervention should be randomly assigned in the case of controlling covariable, otherwise the policy selection bias error problem (Selection Error), cannot be avoided. It requires a large sample and can only calculate the average effect of policy intervention. In this paper, we use the new synthetic control method (Synthetic Control Method) to evaluate the economic growth effect of the establishment of the "New Special Zone. The basic idea of synthetic control method is derived from Abadie and Gardeazabal (2003), and Abadie (2010, 2015) built the theoretical basis of econometrics for this method. For purposes, synthetic control methods are primarily used to assess the impact of a major historical event or

important policy on affected areas under small sample conditions, for example, (Abadie and Gardeazabal (2003) used to assess the impact of large-scale terrorist attacks on economic growth in the Basque region of Spain. [14][15][16]

Specifically, the basic idea of the synthetic control approach is as follows: If the researchers want to assess the causal effect (Treatment Effect) of a significant historical event or important policy in reality on one or more of the affected objects (that is, the experimental unit), but it is impossible to find individuals that are exactly the same as the main characteristics of the experimental unit (that is, the control unit, Control Unit), this moment, researchers can weighted the weights of a number of control units (referred to as basic control units in this paper) that are similar to the experimental units, so as to synthesize a control unit which is similar to the main characteristics of the experimental unit. (this paper is called the composite control unit to distinguish it from the basic control unit), then, the causality effect of the event or policy on the experimental unit is evaluated by comparing the experimental unit and the composite control unit. In particular, in order to make the conclusion of synthetic control method more reliable, researchers need at least one control unit which is similar to the experimental unit.

In this paper, the economic data of T period in J + 1 provinces, including Liaoning Province, Only Liaoning Province was directly affected by the "Free Trade area" policy experiment in the T_0 ($1 < T_0 < T$) period (that is, 2017.11) and thereafter, so Liaoning Province was the experimental unit, the other J provinces were not affected by the "free trade area" in the T period, and can be selected wholly as the basic control unit of Liaoning Province. Further, the causal effect of the "Free Trade area" on economic growth in Liaoning Province (recorded as i) can be expressed as:

$$\tau_{it} = Y_{it}(1) - Y_{it}(0)$$

In the above formula, $Y_{it}(1)$ and $Y_{it}(0)$ are two result variables, in which, $Y_{it}(1)$ indicates the result of Tianjin being affected by "free trade area" in every period after 2017.11 (actual occurrence), $Y_{it}(0)$ indicates the result (counter-fact) of Liaoning Province in every period after 2017.11 when it is not affected by "Free Trade area", which can not be observed, that is, the problem of lack of counter-fact. To solve this problem, the synthetic control method constructs a weighted average of the desired weights for all basic control units, and thus generates a synthetic control unit for the experimental unit Tianjin, and estimates the missing counter-fact $Y_{it}(0)$. Then, by comparing and analyzing the economic growth results of experimental unit and synthetic control unit, we can evaluate the impact of "free trade area" on Liaoning economy.

B. Data Specification

According to the theory of economic growth, this paper selects the macroeconomic indexes such as trade volume of

import and export goods, trade volume of imported goods, and trade volume of export goods, fixed asset investment (INVESTMENT) GDP growth rate as the model variable. Because of the lack of monthly data of GDP index, this paper adopts the growth rate of industrial added value as the proxy variable of GDP, among them, GDP, the fixed assets investment, import value and export value measure economic growth, investment and import and export in the process of economic development respectively. Considering that the "data squeezing" in Liaoning Province in 2016 will have an impact on the results of the study, therefore, the paper selects the time span after water squeeze is 22 monthly sample data from August 2016 to July 2018. Through research, we learned that although the Liaoning free trade area was officially listed on April 10, 2017, its policy implementation and internal institutions will officially play their role by the end of 2017. Therefore, this paper selects August 2016-November 2017 as the prior window period of Liaoning Free Trade Zone, and December 2017-July 2018 as the ex post window period. In order to ensure the validity of the data and reduce the influence of heteroscedasticity, the paper adopts the Year-on-year growth rate to reduce the seasonal factors influence on the economic growth, and ensures the stability of the data and digital processing. The original data are mainly from monthly data of Guotai a database and the Central Economic Network statistical database. China (Shanghai) Free Trade Zone (FTAA) was established on September 29, 2013, then, on April 21, 2015, Free trade area was established in Guangdong, Tianjin and Fujian respectively. Free trade area was established in Liaoning, Zhejiang, Henan, Hubei, Chongqing, Sichuan and Shanxi province on April 1, 2017 respectively. In this paper, 25 provincial administrative regions of China are selected as the object of investigation (Zhejiang, Henan, Hubei, Chongqing,

Sichuan and Shanxi provinces have also set up free trade zones during the investigation period, these provinces and Hong Kong, Macao and Taiwan regions are not considered in the analysis).

III. EMPIRICAL RESULTS ANALYSIS AND ROBUSTNESS TEST

As shown in "Table I", the composite control method is used to obtain the weight combination structure of provinces and cities in Liaoning Province. As can be seen from "Table I", in the synthetic Liaoning Province, Beijing has a weight of 41%, Hebei Province has a weight of 33.2%, Anhui Province has a weight of 4.1%, and Shandong Province has a weight of 19.6%. The remaining provincial regions have a weight of 0. This result is consistent with the reality: Beijing, Hebei, Shandong and Liaoning Province are adjacent to each other, belong to the Bohai Sea economic group, and there is more cooperation and exchange among regions; There are many similarities between Anhui Province and Liaoning Province in economic development.

Whether the synthetic Liaoning is similar to the real Liaoning is related to the accuracy of using the synthetic control method to evaluate the economic effect of Liaoning Free Trade area. For this reason, further comparing the data between Synthetic Liaoning and real Liaoning before the establishment of the free trade area, it is found that the synthetic Liaoning and the real Liaoning have achieved a better fitting. It shows that the synthetic control method fits the characteristics of Liaoning before the establishment of the free trade area and is suitable for evaluating the effect of the policy of the free trade area in Liaoning province. On this basis, the synthetic Liaoning and the real Liaoning change path can be obtained.

TABLE I. PROVINCIAL WEIGHT OF SYNTHETIC LIAONING

Beijing Municipality	Tianjin Municipality	Hebei Province	Shanxi Province	Neimengu	Jilin Province	Heilongjiang	Shanghai Municipality	Jiangsu Province	Anhui Province	Fujian Province	Jiangxi Province
0.041	0	0.332	0	0	0	0	0	0	0.429	0	0
Shandong Province	Hunan Province	Guangdong Province	Guangxi	Hainan Province	Guizhou Province	Yunnan Province	Tibet	Gansu Province	Qinghai Province	Ningxia	Xinjiang
0.196	0	0	0	0	0	0	0	0	0	0	0

A. An Analysis of the Effect on Import and Export Trade

"Fig. 2" shows the path change of the true Liaoning import and export trade volume in the sample period and the synthetic Liaoning import and export trade volume obtained by the synthetic control method. Among them, the horizontal axis represents the time, the vertical axis represents the import and export trade volume of Liaoning, and the vertical dotted line represents the first month of the post window period of Liaoning Free Trade area, that is, November 2011.

As can be seen from "Fig. 2", before the establishment of the Liaoning Free Trade Zone, the changing paths of the volume of import and export trade between the synthetic Liaoning Province and the real Liaoning Province were very similar, the changing trend was completely consistent, and it could almost completely coincide. It can be seen that the

synthetic Liaoning can copy the situation before the establishment of Liaoning Free Trade area, and can be used as a control group to analyze the policy effect of Liaoning free trade area. From the first month after the establishment of Liaoning Free Trade area (November 2017), import and export trade volume of real Liaoning is gradually higher than that of synthetic Liaoning, and the gap between the two gradually increases with the increase of time. The difference between the two means that compared with Liaoning, where there is no free trade area, the establishment of free trade area has promoted Liaoning's import and export trade volume. (See "Fig. 1")

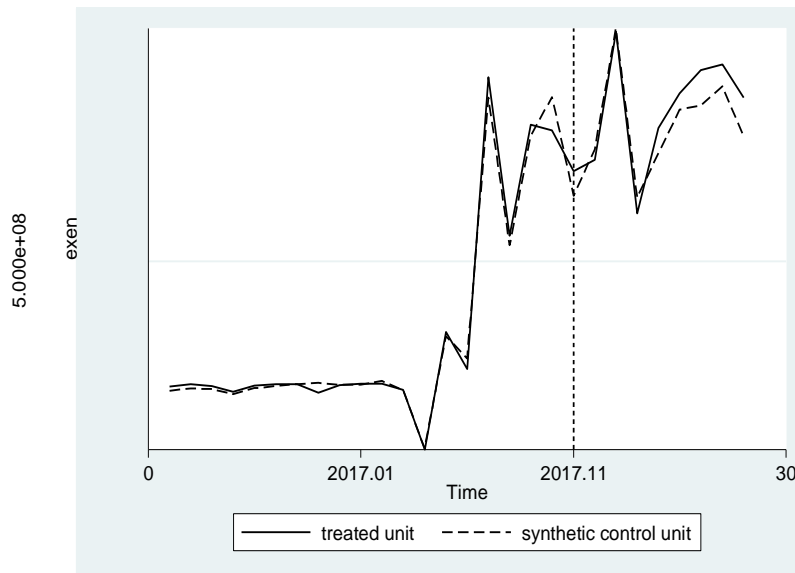


Fig. 1. Comparison of import and export trade volume between real Liaoning and synthetic Liaoning.

In order to more clearly reflect the influence of the establishment of Liaoning free trade area on the import and export trade volume of Liaoning, this paper calculates the trend of the difference between import and export trade volume

between real Liaoning and synthetic Liaoning before and after the establishment of Liaoning Free Trade area, also known as "processing effect", as shown in "Fig. 3", Where the horizontal dotted line is a reference value of 0.



Fig. 2. The gap between the volume of import and export trade between real Liaoning and synthetic Liaoning.

As can be seen from "Fig. 3", before the Free Trade area was established and formally played its role, the difference between them fluctuated mostly around the zero value, and the amplitude of shock was relatively small. After the establishment of the Free Trade area, the difference between the two gradually turned into a positive number, and with the development of time, the difference between the two gradually expanded. In March 2018, the processing effect was 0.1, that is, the establishment of the Liaoning Free Trade area during that period led to an increase of 10 percent in the volume of import and export trade in Liaoning. In addition, during the whole post-event window period, the average "treatment effect" of the

establishment of Liaoning free trade area on import and export reached 0.15, that is, 15%. It can be seen that since November 2017 the competition effect, spillover effect and international trade effect associated with the establishment of Liaoning free trade area have significantly improved the level of import and export of Liaoning.

In order to further analyze the internal mechanism of the impact of the establishment of the Free Trade Area on import and export trade, in this paper, the effects of the establishment of the free trade area on volume of import and volume of export of Liaoning Province respectively are obtained by

means of synthetic control method, as shown in “Fig. 3”, “Fig. 4”, “Fig. 5” and “Fig. 6”.

Among them, the export volume is similar to the total import and export volume, before the establishment of the free trade zone, the export volume of real Liaoning and synthetic Liaoning has a higher fitting degree; After the establishment of the Free Trade area, the true value of Liaoning export value is obviously higher than the synthetic value, and the disparity has the tendency that expands gradually. The average "treatment effect" of the establishment of Liaoning Free Trade area on Liaoning export volume of goods is positive (mean value is

0.115). By observing the difference between the true value and the composite value of the "treatment effect" of the Free Trade Area, we can find that before the establishment of the, we can find that before the establishment of the free trade area, the difference of export value is near zero, small shock. After the establishment of the free trade area, the difference showed an increasing trend with time and remained positive, which indicates that the policy of free trade area has a significant positive impact on the export value of goods in Liaoning Province, and the effect reflects a trend of gradual expansion over time.

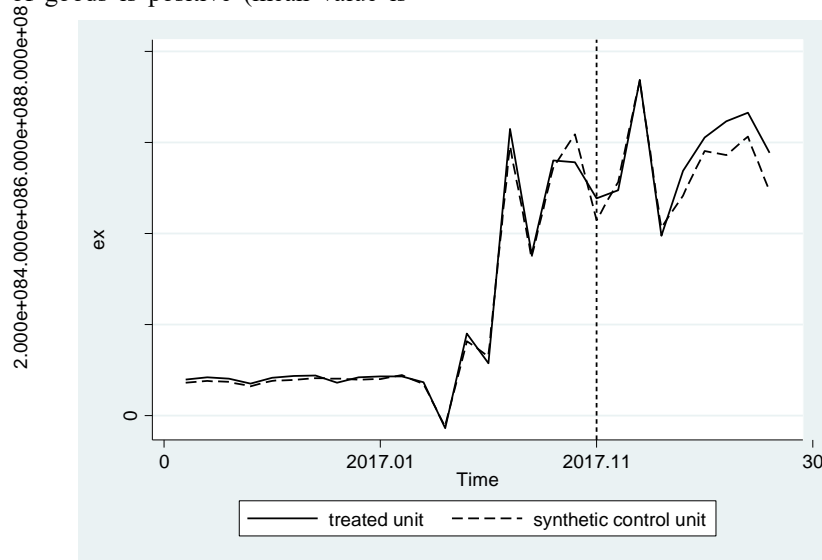


Fig. 3. Comparison of export trade volume between real Liaoning and synthetic Liaoning.

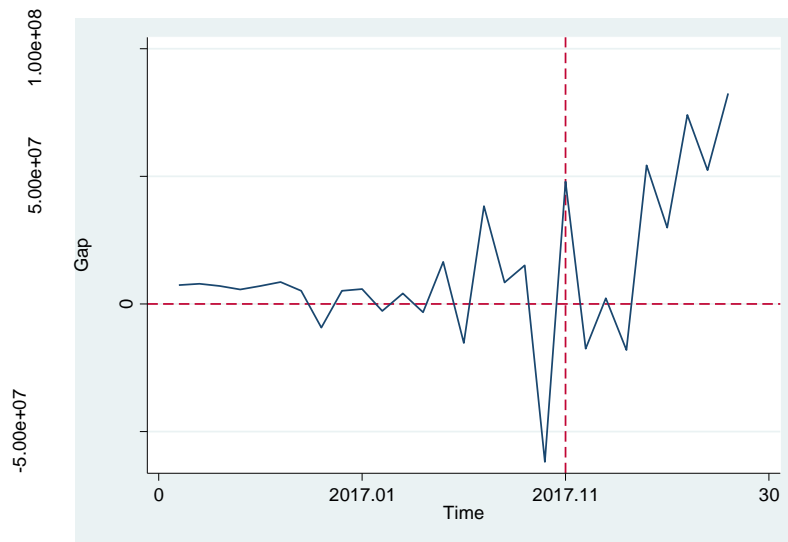


Fig. 4. Real Liaoning and synthetic Liaoning export trade volume gap.

From “Fig. 5” and “Fig. 6”, it can be seen that the average "treatment effect" of the establishment of Liaoning Free Trade Zone on the volume of imports of goods in Liaoning Province is not significant. By observing the fitting figures of the import value of real Liaoning and synthetic Liaoning, we can see that the fitting trend of volume of imports between real Liaoning

and synthetic Liaoning has been good in the sample range, and there is no obvious change before and after the establishment of the free trade area. According to the difference between the volume of imports of real Liaoning and that of synthetic Liaoning, the difference of export value has been fluctuating in

the range of 0 before and after the establishment of the free trade area, and there is no obvious change trend.

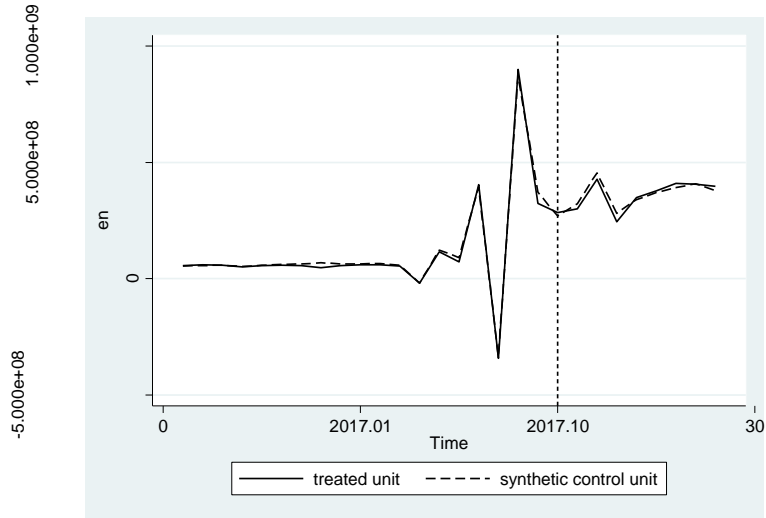


Fig. 5. Comparison of import trade volume between real Liaoning and synthetic Liaoning.

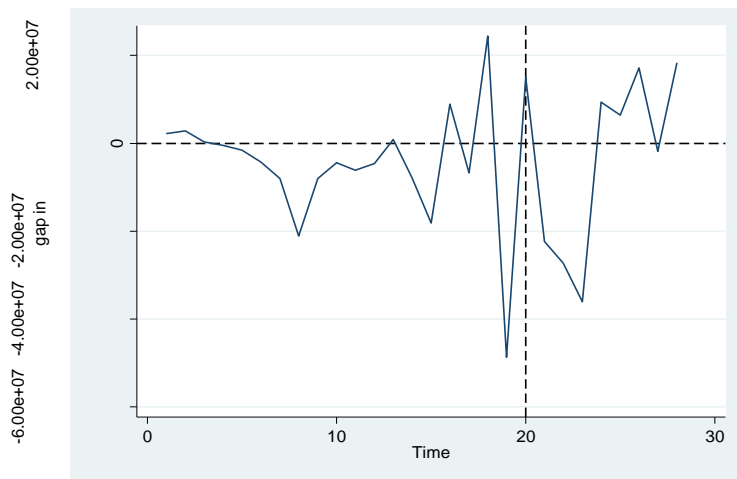


Fig. 6. The difference between import trade volume of real Liaoning and synthetic Liaoning.

To sum up, the impact of the establishment of the free trade area on the import and export goods trade of Liaoning Province is reflected in the increase of export value, but the import value has no significant effect. There are several reasons for the difference between import trade and export trade in Liaoning province due to the establishment of Liaoning free trade area. First of all, Liaoning Province is an old industrial base and heavy industry is relatively developed. Various trade facilitation policies brought about by the establishment of free trade zone have greatly relaxed the trading restrictions on such products, which is helpful to promote the export of technology and equipment to Liaoning Province by foreign-funded enterprises. Secondly, Liaoning faces economic recession and population loss in recent years, which limits the demand for imported goods. With the establishment of the Free Trade area, the threshold for import and export commodities to enter the domestic market has been further relaxed, which has stimulated the demand for export commodities from countries such as South Korea and Japan, and provided sufficient impetus for the

rapid development of export trade in Liaoning Province. In a short period of time, the free trade area promotes the export of goods more than imports, which makes the trade surplus of goods expand.

B. An Analysis of the Policy Effect of Economic Growth and Investment

In order to measure the effect of the establishment of Liaoning Free Trade Zone on Liaoning economic growth, this paper uses the same method to construct and synthesize Liaoning. It also compares the real Liaoning and synthetic Liaoning industrial value-added growth rate before and after the establishment of the free trade zone and the relative difference in the year-on-year growth rate of the investment in fixed assets, which is regarded as the "treatment effect" of the Free Trade area 's establishment. As shown in "Fig. 7" and "Fig. 8".

As can be seen from “Fig. 7”, before the establishment of the Liaoning free trade area, the path of economic growth changes in the synthetic Liaoning Province and the real Liaoning Province is very similar. The trend of change is completely consistent, and it could almost completely coincide with each other. It can be seen that the synthetic Liaoning can copy the situation before the establishment of Liaoning free trade area, and can be used as a control group to analyze the policy effect of Liaoning free trade area. Starting from the first

month after the establishment and functioning of Liaoning free trade area (November 2017), import and export trade volume of real Liaoning is gradually higher than that of synthetic Liaoning, and the gap between the two gradually increases with the increase of time. The gap between the two means that compared with Liaoning, where no free trade area has been established, establishment of the free trade area has promoted Liaoning’s economic growth.

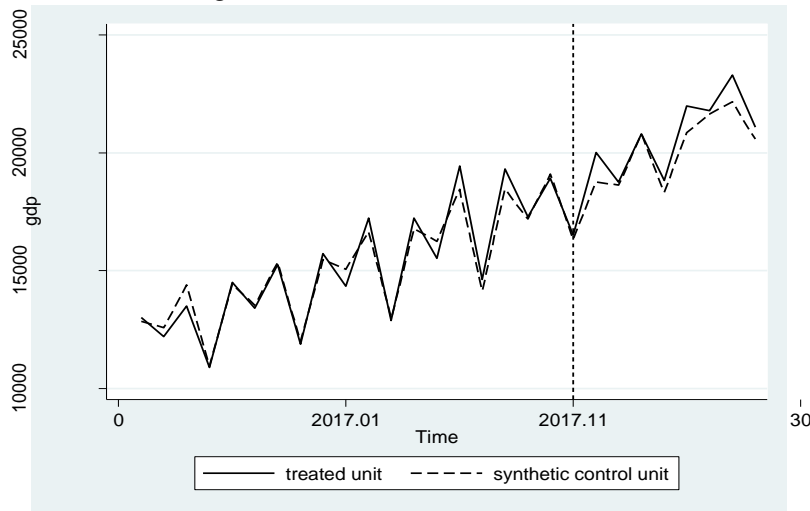


Fig. 7. Comparison of economic growth rate between real Liaoning and synthetic Liaoning.

As can be seen from “Fig. 8”, before the establishment of the free trade area, the gap between the real value and the composite value of economic growth in Liaoning Province remained between -900 and 1000; After the establishment of the free trade area, the gap between the two is always positive, which reached the maximum value of 1250 in December 2017,

and the average value of "treatment effect" is 600. Therefore, since November 2017, the competition effect, spillover effect and international trade effect of the establishment of Liaoning free trade area have significantly improved the economic growth level of Liaoning Province.

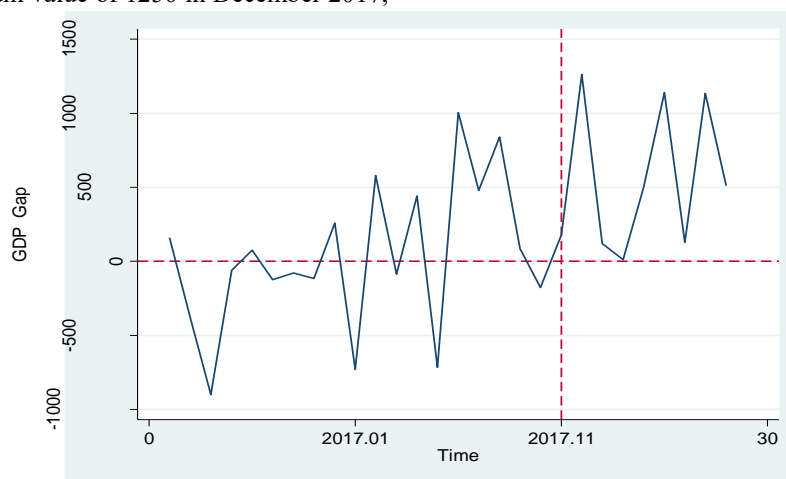


Fig. 8. Economic growth gap between real Liaoning and synthetic Liaoning.

In order to measure the effect of the establishment of Liaoning free trade area on the fixed assets investment of Liaoning Province, this paper uses the same method to construct and synthesize Liaoning Province, and compares the real Liaoning and synthetic Liaoning fixed assets investment before and after the establishment of the free trade area, which

is the "treatment effect" of establishment of the free trade area. As shown in “Fig. 9”, the average "treatment effect" of the establishment of Liaoning Free Trade Zone on fixed assets investment in Liaoning Province is not significant. By observing the fitting diagram of real Liaoning and synthetic Liaoning fixed assets investment, we can see that the fitting

trend of real Liaoning and synthetic Liaoning fixed assets investment in the sample interval has been good, and there is

no obvious change before and after the establishment of the free trade area.

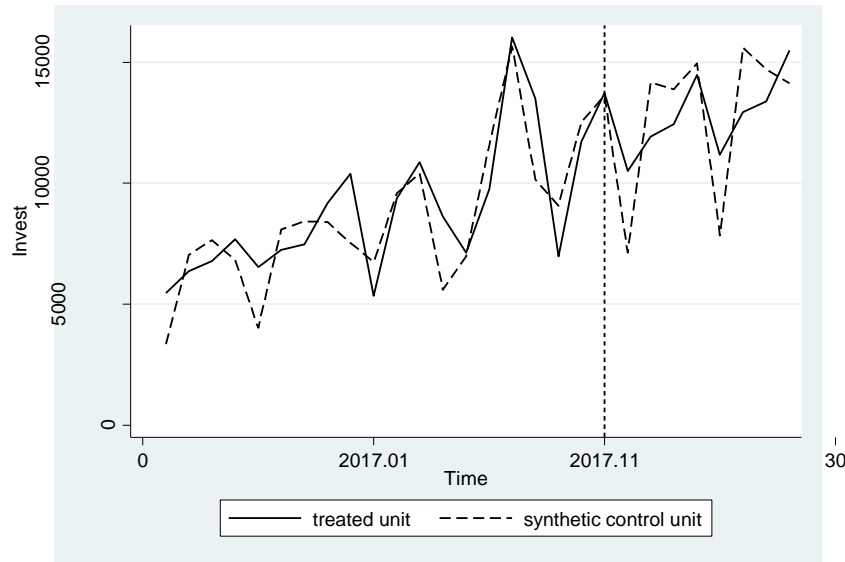


Fig. 9. Comparison of fixed assets investment between real Liaoning and synthetic Liaoning.

As shown in “Fig.10”, until November 2017, the gap between the true value of fixed asset investment and the composite value of Liaoning Province remained between -2000 and 3000; After the establishment of the free trade area, the gap between the two is positive or negative, which reached a maximum of 3600 in December 2017 and a minimum of -2500 in May 2018. The difference between the real value and the

composite value in the sample period fluctuates in the vicinity of zero value many times, and has no obvious time trend characteristic, so it can not be explained by the synthetic control method that the establishment of free trade zone has significant influence on the growth of fixed assets investment in Liaoning province.

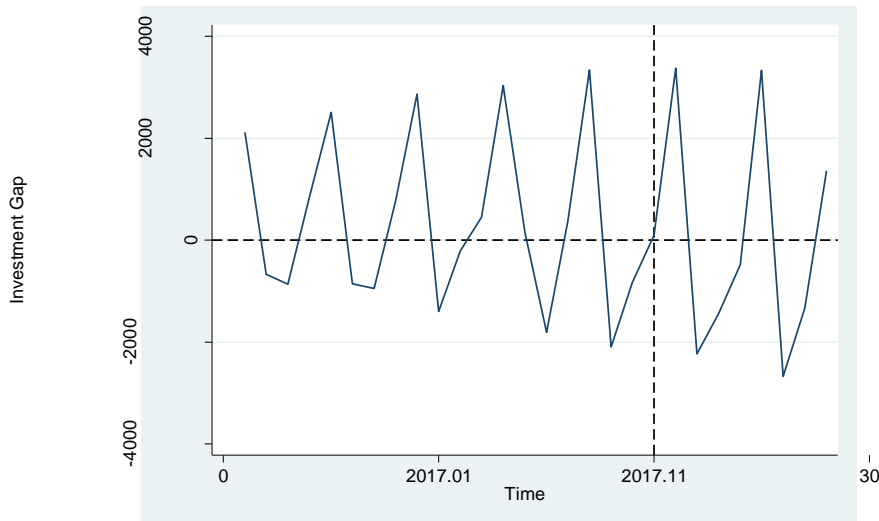


Fig. 10. The gap between fixed assets investment of real Liaoning and synthetic Liaoning.

C. Robustness Test

In order to verify the robustness and validity of the above results, and to verify that the differences of economic indicators before and after the establishment of Liaoning free trade area are not due to other unobserved external factors, the “treatment effect” of empirical estimates is statistically significant. This paper uses the placebo test conducted by

Abadie et al. (2010) to examine other provinces and cities outside Liaoning Province. If the Free Trade Areas were also established and functioning in November 2017, according to the synthetic control method introduced above, the synthetic control objects are constructed by using other potential control groups, whether the economic effects similar to those brought by the establishment of Liaoning free trade area can be obtained, and the basic ideas are as follows:

The ratio of "post-intervention MSPE" to "pre-intervention MSPE" 1 in Liaoning Province and other regions is compared. For the processing area of Liaoning Province, if the establishment of the free trade area has a significant impact on the total import and export volume of Liaoning Province, then the synthetic Liaoning Province will not be able to well predict the true import and export volume of Liaoning Province after the establishment of the Free Trade Zone, which lead to larger "post-intervention MSPE";If, before the establishment of the free trade zone, the synthetic region can not predict the result variables of the real area (that is, the larger "MSPE" before intervention), and will result in a larger "post-intervention MSPE". So, take the ratio of the two, if the establishment of Liaoning free trade area can really have a significant policy impact, and the placebo effect in other regions is very small, it should be observed that the ratio of Liaoning MSPE is obviously higher than that of other provinces and cities.

In general, the ratio of post-intervention MSPE to pre-intervention MSPE is used to reflect the difference between the results of empirical analysis and the placebo test. MSPE (mean square prediction error) is used as the fitting difference

between the target region and the synthetic region, which represents the difference between the policy implementation area and the synthetic control area. Formula for calculating MSPE before intervention:

$$MSPE = \frac{1}{T_0} \sum_{t=1}^{T_0} (y_{1t} - \sum_{p=2}^{p+1} \omega_p^* y_{pt})^2$$

Similarly, the MSPE expression after intervention can be written, it's just that the average interval of the square of the prediction error is different. Abadi et al. (2010) pointed out that when the MSPE value of the policy "before intervention" is larger (the fitting effect of the synthesis control is poor), the MSPE value "after intervention" may also be very large, and thus may result in a bias in the result. Therefore, the difference between the two is generally taken to control the influence of the former. If the establishment of Liaoning free trade area does have an impact on economic activity, the placebo effect in other regions is small, and the ratio of "pre-intervention" MSPE to "post-intervention" MSPE in Liaoning should be higher than elsewhere, as "Fig. 4" confirms.

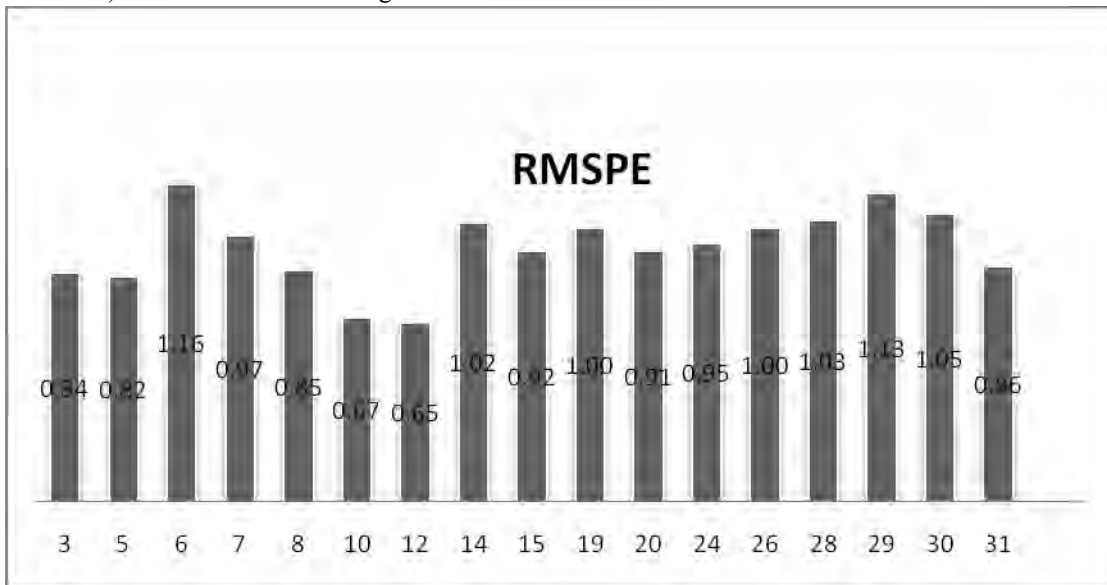


Fig. 11. Distribution of MSPE before MSPE/ intervention in Liaoning and synthetic areas.

By calculating the ratio of MSPE in all regions, it can be found that the ratio of "MSPE after intervention" to "MSPE before intervention" in Liaoning is the highest, reaching 1.16, which indicates that the economic effect of Liaoning Free Trade area obtained by synthetic control method is robust. If a free trade area is set up by a random method, the probability of obtaining a MSPE value as high as that of Liaoning is $1 / 17 = 0.059$, that is, 5.9%, this indicates that the assumption that the establishment of Liaoning free trade area has a significant

positive impact on Liaoning is not caused by accidental factors at the level of 94.1% significance.

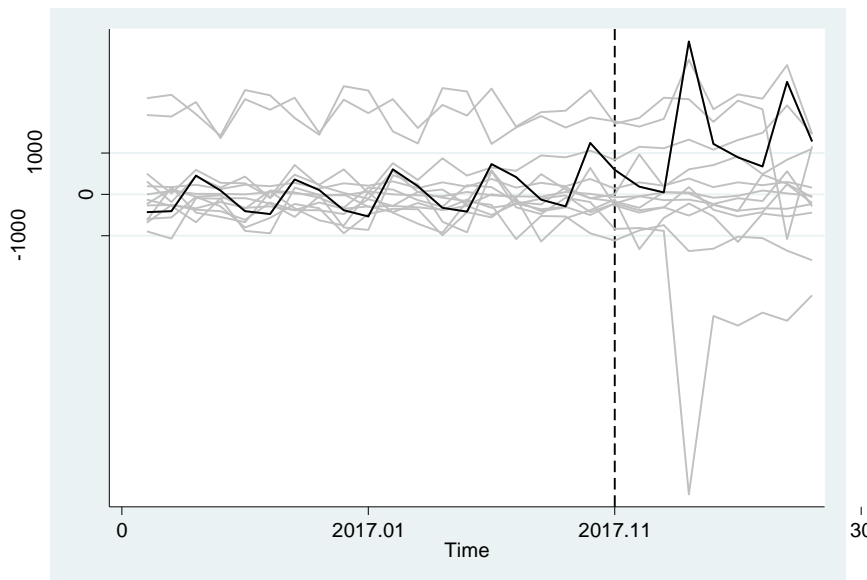


Fig. 12. Comparison of the gap between the actual region and the synthetic region.

In the “Fig. 11” and “Fig. 12” above, the black line represents the processing effect of Liaoning free trade area, (That is, the difference of economic growth between Liaoning and synthetic Liaoning); the gray line represents the placebo effect in the other 16 controlled prefectures (that is, the difference between the economic growth of these provinces and their corresponding composite provinces and cities). Obviously, compared with the placebo effect of other prefectures, Liaoning’s treatment effect is particularly large. If Liaoning’s free trade zone does not have any effect on the economy, the probability that the prefecture happens to have the greatest processing effect in these 17 provinces and cities is only $1 / 17 = 0.059$, which is exactly the usual level of significance.

IV. CONCLUSION

In this paper, the effects of the establishment of Liaoning free trade area on economic indicators such as import and export trade, economic growth and investment in the region are investigated by means of synthetic control method. The empirical results show that the establishment of Liaoning free trade area has a different degree of impact on the regional economic operation, and there are obvious differences in the economic impact of the free trade area. The economic effect of the establishment of Liaoning free trade area is mainly reflected in the promotion of Liaoning’s export trade, while the impact of import trade is not significant, the effect of the establishment of the free trade area on economic growth is significant. Free trade area to Liaoning Province fixed asset investment plays a significant role in promoting. All of the above results passed the robustness test of the placebo method. The empirical results of this paper confirm the positive effects of establishing free trade zones, promoting the process of trade liberalization, and vigorously developing special economic regions in line with the international market on economic growth. However, there are some problems, such as import

trade and fixed assets investment in Liaoning Province is not obvious.

The explanation of the positive effect of Free Trade area on regional economy can be summarized into the following three aspects. Free trade area has transformed government functions, improved the trading environment and produced economies of scale. By using a forced mechanism to promote development through reform and changing the positive list into a negative list and the auditing system into a record system, the free trade area can make the government management more legal, stable and predictable, cut off the "rent-seeking hand" and improve the efficiency of work; Through loosening foreign exchange control, basically lifting restrictions on cross-border capital flow, exploring investment and financing exchange facilities, providing a variety of hedging means, Free Trade Area will create convenient conditions for enterprises to invest abroad and improve the financing capacity of overseas investment enterprises. Secondly, the Free trade area is supported by a large number of enterprises with the characteristics of "platform economy" to attract the inflow of high-tech talents and encourage technological innovation. Relying on its specific location and resource conditions and the highly developed modern service industry, the free trade area has already had a large number of domestic and foreign trade, finance, logistics, information platform enterprises, so as to form a strong domestic and foreign resources allocation capacity of the economic function and economic development model. According to endogenous growth theory, knowledge is an important input in economic life, if knowledge is regarded as capital; there is a constant or even incremental rate of growth in science, technology and innovation. The endogenous and biochemical steady growth path gradually eliminated those enterprises with low production efficiency, while those enterprises with high production efficiency were affected by the accumulation rate of knowledge elements, so that they could obtain more high-quality resources and achieve the purpose of "superior coin expelling inferior coins", and

enhance the overall competitive strength of the region. Third, the existence of spillover effect. The reform and preferential policies of government supervision and approval, investment, trade, finance, taxation and other key areas in the free trade area will reduce the circulation cost of production factors such as capital and labor, and attract production resources to gather there. In the short term, it may have a "crowding out" effect on the economies of other neighboring provinces.

The effect of free trade area on import trade and fixed assets investment in Liaoning Province is not obvious, so it is necessary to analyze the present economic situation of Liaoning Province. The economic structure of northeast China is more dependent on investment and state-owned enterprise manufacturing. Compared with other regions, the industrial structure is at a disadvantage, resulting in a surplus of labor force. With the extremely low fertility rate and the outflow of young people, the aging of Liaoning Province has been accelerated, and gradually lost the excellent labor force and the consumer with strong purchasing power, the reserve labor resources are seriously insufficient, which to a certain extent has restrained the free trade area to the import trade function. In addition, because of the rigid system, resulting in higher "institutional costs", many small and medium-sized enterprises have moved to Tianjin, Hebei and other places, which affects fixed asset investment in Liaoning. At the same time, influenced by the international economic situation, Japan, South Korea, which is closer to Liaoning, have seen a sharp drop in investment in China, which has affected the role of the free trade zone in promoting fixed asset investment in Liaoning province.

In view of this, Liaoning should speed up the construction of a new open economy system, explore the way of developing free trade zones to upgrade free trade ports, improve the construction of the system and mechanism of the free trade zones, realize the free flow of goods, services, capital and talents in the region, and build fairness. Liaoning should build a free trade area with fair competition, efficiency and international economic integration, which will increase the knowledge stock, enhance innovation consciousness, facilitate information circulation, and promote the promotion of regional innovation ability. In addition, Liaoning should speed up replication, popularize the experience of the established free trade areas, strengthen the linkage between the surrounding areas of the free trade areas, adjust the industrial structure, provide more employment opportunities, attract and retain talents, and further improve Liaoning's competitiveness.

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