Degree of Dependence upon Foreign Trade Based on Uncertainty Analysis

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Abstract

With the COVID-19 outbreak in the world, countries began to take basic measures such as lockdown and quarantine, which on the one hand prevented the spread of the epidemic but on the other hand had a significant impact on the global value chain. As a result, how to reduce the trade dependence of each province and strengthen the depth and length of the global industrial chain in China has become a hot topic at present. In this paper, the influence of economic policy uncertainty on China's import and export trade is discussed based on China's provincial panel data from 2003 to 2017 and the quantile dynamic panel fixed effect model. The empirical results show that macroeconomic uncertainties reduce the dependence on foreign trade of domestic provinces, and have different degrees of impact on import and export, which are significantly different in different economic periods and different regions. Specifically, the economic policy uncertainty will weaken the dependence on foreign trade of each province, especially in the eastern region than in the central and western regions, and the impact of this uncertainty is more obvious when the economy is in a downward cycle. However, increasing R&D investment and FDI in each province will further reduce its dependence on foreign trade. Therefore, it is concluded that the implementation of economic policies at different stages of the economic cycle needs to be coordinated with different levels of regional development, and focus on strengthening the R&D investment and increasing foreign direct investment in each province.

Keywords: Uncertainty, dependence on foreign trade, investment in research and development, FDI

I. Introduction

The COVID-19 outbreak has hit not only China but also developed countries, with confirmed cases in more than 210 countries and regions currently around the world. However, as the number of infected people in China decreased, enterprises began to resume production on a large scale. By contrast, the United States is now the epicenter of COVID-19 outbreak, with more than 2 million people confirmed and more than 110,000 dead. After March 8, the stock market halted four times in a row. There have been five times in total since the establishment of the circuit breaker mechanism in 1987, four of which were in the two weeks of March, and the American stock market fell down, falling by more than 30%. The stock market crash in the United States also affected Europe, causing stock markets in some countries in the world to fall by nearly 40% and causing a sharp increase in the unemployment rate in the United States. According to data released on May 8, America's unemployment rate is now the highest since the World War II.

The COVID-19 outbreak is a once-in-a-century infectious disease, which affects the demand side, the supply side, the cities and the countryside. After controlling the epidemic situation in China, it has been twice affected by the epidemic crisis in foreign countries. Although after more than 40 years of reform and opening-up, China's achievements in the economic, social, political, cultural and other fields are comparable to the miracle of world development, but the economic globalization also makes China's economy more vulnerable to the impact of world economic fluctuations. On April 17, the Bureau of Statistics announced a growth of -6.8% in the first quarter, the first negative growth since the quarterly statistics began in 1992 and the largest negative growth since the reform and opening-up. After the financial crisis in Southeast Asia, the subprime mortgage crisis in the United States, the debt crisis in Europe, the trade war between China and the United States and the COVID-19 outbreak, more

uncertainties have emerged in the process of China's industrial internationalization. The "belt and road initiative" and RCEP have further deepened the embedding level of Chinese enterprises in the global value chain [1]. The economic policy uncertainty means that politicians and regulators often make decisions to change the current market environment, and economic entities cannot predict the characteristics and direction of the changes [2]. The uncertainty of economic policies has led to a slowdown in the growth of domestic investment and trade. For developed countries and the world economy, in fact, since the second half of last year, some major international institutions, such as the International Monetary Fund and the World Bank, have continuously lowered their growth expectations. In this case, various countries have taken many measures to adjust the state of economic development. For example, recently, the Federal Reserve adopted a $700 billion bailout and unlimited loose monetary policy. The U.S. government has also issued a $2.2 trillion aid program to help families and businesses, reaching 10% of its GDP. In addition, European countries, including very conservative Germany, have introduced relief plans amounting to 10% of GDP, while Britain, Canada and Japan have introduced fiscal stimulus plans amounting to 20% of GDP. Moreover, the People's Bank of China also frequently stimulated its economic development through open market operations [3].

In recent years, by virtue of its huge demographic dividend and favorable business environment, China has played a pivotal role in global trade, with import and export volume increasing from 556.01 billion yuan in 1990 to 24,550.29 billion yuan in 2015, an increase of 43.15 times, with an average annual growth rate of 16.36%. In the same period, China's GDP increased from 1,887.29 billion yuan to 68,550.58 billion yuan, an increase of 35.32 times and an average annual increase of 15.45%. However, China, as the world's largest intermediate trading country, has the advantages of foreign trade products, which are mainly embodied in labor-intensive products and are extremely vulnerable to economic policy shocks. (Xie Kejin, Cai Yunzhi and Bao Shangyan) [4] found that the rising labor cost in China after the revision of labor law has a significant negative impact on attracting FDI. Since 2018, Trump has imposed tariffs on imports from China on the grounds of balancing the trade deficit, and restricted the export of American enterprises to China, which has had a great impact on China's foreign trade industry.

II. Literature Review

Economic policy uncertainty not only affects macro subjects, but also has a stronger dynamic effect on micro subjects. After all, various choices and decisions of various subjects in the market jointly affect the economic results [5], which cannot be observed directly, so all current indicators are not real variables, but just proxy variables of economic policy uncertainty.Other scholars have studied the relationship between uncertainty and corporate governance [6].

In the selection of economic policy uncertainty, domestic scholars partially use the conditional variance of macroeconomic indicators and the volatility of business performance to measure the uncertainty faced by enterprises. For example, (Wang Yizhong and Song Min) [7] used the generalized autoregressive conditional heteroscedasticity model to measure the conditional variance of China's quarterly real GDP change rate. (Shen Huihui, Yu Peng and Wu Liansheng) [8] measured the difference between the standard deviation of the current sales revenue and the standard deviation of the previous sales revenue from the micro level. In addition, (Jia Qian, Kong Xiang and Sun Zheng) [9] chose the replacement of provincial principal officials as the independent variable. Although the change of local government overcomes the endogenous problem by using conditional variance of economic indicators before, it has discontinuity. Similarly, foreign scholars have done a lot of research on the measurement of economic policy uncertainty. (Scott R. Baker, Nicholas Bloom and Steven J. Davis) [10-12] selected the number of news reports in different time periods by searching for three keywords: "China", "economic policy" and "uncertainty" based on *South China Morning Post*, the largest English-language newspaper in Hong Kong, and obtained the EPU index, which has better continuity and time variability, and can accurately reflect the short-term and medium-term adjustment of economic policy. Therefore, in this paper, EPU index is also used as an

index to measure the economic policy uncertainty.

Most scholars have discussed the impact of economic policy uncertainty from the micro-subject, that is, the enterprise level. On the basis of explaining the irreversibility of investment, the real option theory emphasizes that enterprises have corresponding value for non-investment, immediate investment and long-term investment under the condition of high economic and political uncertainty. Therefore, we cannot deny the economic benefits of stopping investment by enterprises. Similarly, investment by enterprises has a significant impact on the import and export of the whole country. (Li Fengyu and Yang Mozhu) [2] found through research that the rising economic policy uncertainty will inhibit the investment of enterprises, which is more remarkable after the financial crisis in 2008. (Yu Wenchao and Liang Pinghan) [13] found that the uncertainty of local policies or the uncertainty of trade environment will significantly damage the operating vitality of private enterprises, such as reducing the opening rate after controlling other factors unchanged. However, many experts and scholars have found that this uncertainty has a certain positive impact. (Wang Yizhong and Song Min) [7] found that macroeconomic uncertainty can increase the marginal rate of return on capital, which in turn leads to increased investment, but weakens the positive impact of external demand, liquidity and long-term capital demand on corporate investment. Based on the data of China's A-share listed companies, (Lan Faqin and Cai Nading) [14] found that the uncertainty of economic policies promotes enterprises to participate in M&A and increase the scale of M&A, but they have different sensitivities for different fiscal, monetary and trade policies. (Ju Ruibo and Zhang Lu) [5] found through analysis that the uncertainty of domestic economy significantly promotes foreign direct investment, especially in industries that are relatively sensitive to production costs based on time-varying parameter vector autoregressive model, which continues to expand over time. In the study of the relationship between economic policy uncertainty and corporate leverage ratio, (Gong Rukai, Xu Yuexing and Wang Dafa) [15] found that the negative impact of uncertainty on corporate leverage ratio has been significantly reduced with the improvement of regional level and the promotion of privatization reform, indicating that the deleveraging policy has achieved significant results since the "new normal" of the economy, but may worsen the financing environment of enterprises.

Most articles focus on tariff policy and other aspects in studying the impact of economic policy uncertainty on foreign trade. In this paper, the domestic economic policy changes are discussed based on the above theoretical basis, and further analysis is made based on the data of China's past provinces' dependence on foreign trade to empirically study the relationship between economic policy uncertainty and dependence on foreign trade.

III. Empirical Model

3.1 Indicators and data selection

(1) The explained variable $I\&E_{it}$ represents the proportion of total import and export volume of Province i in the GDP of the province in the year of t, wherein the statistic specification of import and export volume is the total import and export volume of domestic destinations and sources.

(2) The key explaining variable EPU, i.e., economic policy uncertainty index, is quoted in this paper from China's economic policy uncertainty index compiled by Baker et al., which is relatively popular at present. The original data of this index are jointly released by Stanford University and University of Chicago in the United States.

(3) Other control variables. Industrial structure level (Instr), which is measured by the ratio of the output value of the secondary industry to the total output value of each province. (Han Huixia and Jin Zehu) [16] believe that the industrial structure directly determines the process of upgrading the foreign trade industry in the region. Foreign trade innovation ability (R&D), generally speaking, will directly enhance the foreign trade innovation ability, and has a positive effect on the foreign trade product structure, which is expressed by the R&D investment of each province in this paper. Trade sustainability (Lit), which represents the province's scientific research capacity and

subsequent consumption capacity, uses the illiteracy rate of the population aged 15 years and above in the province as the proxy variable. Transportation infrastructure (Trans), which is expressed herein by reference to the accumulated railway mileage of each province, because (He Yang and Meng Xiaoyu) [17] found that infrastructure construction has certain compensation effect on market conditions. Market-oriented process (MI), which is expressed by the provincial market-oriented index published by the National Economic Research Institute over the years, because on the basis of the basically consistent macro-environment and political system across the country, the marketization process varies greatly from province to province, and the transmission mechanism of economic policies in each province also varies to some extent. Foreign direct investment (FDI), which is introduced with reference to most literatures, because a large number of literatures show that FDI can significantly improve the level of upgrading and rationalization of industrial structure. The level of urbanization (Gov), which is measured by the ratio of urban population to total population based on the practice of relevant scholars, because China's foreign trade is mainly concentrated in cities and towns, and the higher urbanization is, the more beneficial it is to industrial upgrading. Average wage (Pwage), because higher wage level will promote labor employment, and high-quality employment is closely related to the structural differences of export products.

3.2 Measurement models and descriptive statistics

Quantile regression, first proposed by Roger Koenker and Gilbert Bassett in 1978, estimates regression parameters by minimizing the sum of the absolute values of the weighted residuals, and has no assumption on the distribution and variance of error terms. Therefore, it can avoid the limitation of the common least squares method and the parameter estimation is more robust. Because panel data can not only reflect the differences among individuals, but also be suitable for studying the dynamic process of phenomena, modeling with panel data can provide richer information and improve the recognition ability of models. In addition, quantile regression using panel data can give full play to the advantages of panel data model and quantile regression, and can more effectively analyze the degree of influence of the explaining variables on the conditional distribution of the explained variables on different quantiles on the basis of controlling individual differences. Koenker put forward the general form of quantile regression model of fixed effect:

$$Q y_{it} \ (\tau \mid X_{it}) = \alpha_i + X_{it}^T \beta(\tau) + \mu_{it}, \ i=1,2,\ldots, \ Nt=1,2,\ldots,T \tag{1}$$

Where,

y_{it}=the observed value of the explained variable of the i-th individual in the t period;

X_{it}=the observed value of the explaining variable of the i-th individual in the t period, depending on the value of the quantile τ;

α_i=the difference between individuals that do not depend on quantile values and are not controlled by other variables;

τ=the quantile;

μ_{it}=the random error.

In order to fully consider the individual effect, Koenker introduced $\sum_{i=1}^{N}|\alpha_i|$ penalty instead of the traditional Gaussian penalty. The estimated values of panel quantile regression parameters can be obtained by solving the following penalty function:

$$\min_{(\alpha,\beta)} \sum_{k=1}^{q} \sum_{i=1}^{N} \sum_{j=1}^{T} w_k \rho_{\tau k}(y_{ij} - \alpha_i - X_{ij}^T \beta(\tau_k) + \lambda \sum_{i=1}^{N}|\alpha_i| \tag{2}$$

Where, w_k weight is used to control the influence of q quantile $\{\tau_1, \dots, \tau_q\}$ on the estimated value of α_i. , $\rho_\tau(\mu) = \mu[\tau - I(\mu < 0)]$ represents the loss function of linear piecewise quantile. When λ→0, the corresponding fixed-effect estimate can be obtained, and when λ→∞, the estimate of the parameter after eliminating the fixed effect can be obtained.

The data used in this paper from 2003 to 2017 mainly came from *China Statistical Yearbook*, *China Bureau of Labor Statistics*, *China Science and Technology Statistical Yearbook* and the website of the Ministry of Commerce of the People's Republic of China. EPU came from the monthly data jointly released by Stanford University and Chicago University, and the annual data were obtained by arithmetic mean. In addition, data were normalized when using stata16 regression. Descriptive statistics of variables are shown in Table 1.

Table 1 Descriptive statistics

Variable names	Descriptions	Mean	SD	Minimum	Maximum
$I\&E_{it}$	Dependence on foreign trade of import and export	.042475	.0486641	.0017154	.2256493
Imp_{it}	Dependence on foreign trade of export	.0206308	.0244648	.0005044	.1222255
Exp_{it}	Dependence on foreign trade of import	.0218442	.0259885	.0010756	.117494
EPU	Economic policy uncertainty index	158.5827	93.57774	64.96188	364.8328
FDI	Foreign direct investment	959.4754	1673.385	3	17622.27
Trans	Rail mileage	10660.65	13885.65	0	76410.82
R&D	R&D Investment	2747809	4938081	3104	7.00e+07
Gov	Urbanization ratio	50.8814	14.85715	20.85	89.6
Lit	Illiteracy rate	8.134215	7.298656	1.23	54.86
Pwage	Average wage	39026.78	21730.54	10397	131700
MI	Level of marketization	6.202836	2.034273	-.3	11.10926
Instr	Level of industrialization	.457339	.0829545	.19014	.6641966

IV. Empirical Result Analysis

4.1 The impact of economic policy uncertainty on foreign trade dependence

The results of quantile regression model as show in the following Table 2 that at different quantiles, that is, for provinces with different trade dependence, the effects of various factors are different, but the uncertainty of economic policies has a significant negative impact on foreign trade dependence. (Lu Xiaodong and Liu Jingjun) [18] found that economic policy uncertainty would cause domestic exporters and importers to "overreact" and have a negative impact on China's exports, probably because China's manufacturing industry is still at the low end of the global value chain during the sample period, and it is highly sensitive to the market, so enterprises will respond flexibly in the case of economic uncertainty, resulting in a decrease in the trade dependence of all provinces. In addition, the estimation results of other control variables are in line with the theoretical expectations and have better practical explanatory significance. Compared with the ordinary panel regression model, the quantile regression method provides more comprehensive information, and has significant advantages in analyzing the level of foreign trade dependence of the province, which is shown as follows:

Provinces with a 5% quantile have low dependence on foreign trade, which can also be reduced significantly by the economic policy uncertainty. In addition, the improvement of foreign investment and transportation level has significantly reduced the dependence on foreign trade at the level of 1%. Considering the specific reality, mainly in the western provinces of China, resource development and tourism are at the lower end of the global industrial chain as its pillar industries, and its representative industrial chain is closer to the final products than the primary products. In addition, considering the high-speed economic growth stage of China during the sample period and the recent policy call of "cutting overcapacity, reducing excess inventory, deleveraging, lowering costs, and strengthening areas of weakness ", it is easy to find out that all aspects of domestic production capacity has been surplus at that time, while some industrial markets tend to be full and inventories are becoming more and more. In other words, the import dependence of each province has not been adjusted relative to the economic environment.

At the quantile level of 25% and 50%, the impact factors of foreign trade dependence are similar. Compared with 5%, infrastructure construction and the introduction of foreign capital can both strengthen the development of local industries, but the urbanization level has begun to play a prominent role. Urbanization is manifested as the spatial accumulation of labor force, capital and other factors of production. With the industrial accumulation and the expansion of the metropolitan area, the level of urbanization will be further improved, which on the one hand will improve the construction of urbanization, on the other hand will strengthen the development of the secondary and tertiary industries. As a result, a higher level of urbanization will result in larger trade lines. In addition, the income gap between urban and rural areas is also affected, because with the increase of the average wage level, the mobility of the population will be weakened, and with the implementation of policies such as rural revitalization and new infrastructure, the local employment environment of the working population will be improved, which will slow down the development of foreign trade industry and foreign trade level.

The individuals at the level of 75% and 95% are all provinces with higher development level in the east that on the one hand has a huge foreign trade quota with the advantage of the port, and on the other hand has a better business environment to attract more industrial investment. Different from other economic individuals, China has a large scale of economy, and different provinces have different "provincial conditions" such as economy and foreign trade, which may lead to the missing variables that do not change with time [16]. The measurement results show that the economic policy uncertainty has a significant negative effect on foreign trade dependence in the eastern region. Judging from the industrial characteristics of the eastern and central and western regions, the eastern provinces are most affected when facing external shocks. In general, the eastern provinces have a greater dependence on foreign trade than the central and western provinces, which is also in line with the reality of China.

When the domestic economy is facing external shocks, the high degree of trade dependence will cause the government's financial risks and affect the subsequent economic development. Li Ping, Jiang Qiang and Lin Yang [1] believed that the higher the degree of embeddedness of the global value chain, the easier it will be to be statically included in the low-end segment of the global value chain division of labor, and the developing countries

will find it difficult to get rid of the "international division of labor trap" dynamically. Foreign investment and infrastructure construction are significantly negative at different quantile levels, indicating that strengthening infrastructure construction and foreign direct investment can reduce the dependence on foreign trade of each province. Foreign investment, with positive externalities, can promote industrial upgrading and productivity progress through technology spillovers and capital flows. In addition, local enterprises can further expand this effect by actively learning from and drawing on this advanced management experience and innovative technology. Strengthening infrastructure construction not only promotes the technological upgrading of industries in this region, but also helps to form industrial clusters with related products, further reducing production costs and enhancing the flexibility of product production. In short, increasing foreign investment and infrastructure construction will strengthen the substitution of local products and reduce the dependence on foreign trade.

Table 2 Quantile analysis

	(1)	(2)	(3)	(4)	(5)
	FE_05	FE_25	FE_50	FE_75	FE_95
EPU	-10.7036***	-10.5068***	-10.3049***	-10.1170***	-9.9027***
	(0.0396)	(0.0170)	(0.0218)	(0.0341)	(0.0547)
FDI	-0.4349**	-0.4055***	-0.3754***	-0.3474*	-0.3155
	(0.1816)	(0.1091)	(0.1099)	(0.1792)	(0.2798)
Trans	-0.1084**	-0.0953***	-0.0818**	-0.0693	-0.0550
	(0.0532)	(0.0320)	(0.0322)	(0.0525)	(0.0820)
R&D	0.0152	0.0157	0.0162	0.0166	0.0172
	(0.0637)	(0.0382)	(0.0385)	(0.0628)	(0.0981)
Gov	0.0036	0.0032**	0.0028*	0.0024	0.0020
	(0.0024)	(0.0014)	(0.0014)	(0.0023)	(0.0036)
Lit	0.0009	0.0237	0.0471	0.0689	0.0937
	(0.1200)	(0.0720)	(0.0726)	(0.1183)	(0.1848)
Pwage	-0.0117	-0.0948	-0.1801*	-0.2594*	-0.3499
	(0.1594)	(0.0960)	(0.0969)	(0.1571)	(0.2450)
MI	-0.1089	-0.1081	-0.1074	-0.1067	-0.1059

	(0.1226)	(0.0736)	(0.0742)	(0.1210)	(0.1890)
Instr	**0.0180**	**0.0345**	**0.0515**	**0.0673**	**0.0854**
	(0.0609)	(0.0366)	(0.0369)	(0.0601)	(0.0939)
N	**465**	**465**	**465**	**465**	**465**

Standard errors in parentheses, * p < 0.1, * * p < 0.05 and * * * p < 0.01.

4.2 The regression results of time node samples

After 2008, the economic policy uncertainty in China has risen sharply, mainly due to the end of the Olympic economy and the spread of the financial crisis, as well as the economic recession and inflation caused by the central government's "4 trillion yuan" around 2011 [2, 9, 19, 20]. Therefore, this paper divides the data into two parts for regression analysis with 2008 as the node. As shown in Table 3, EPU was insignificant before 2008 after adding control variables, but significantly negative after 2008, indicating that the economic policy uncertainty failed to cause substantial shocks before 2008, mainly because this period was a period of macroeconomic upturn in China, during which the effects of external shocks would be weakened [7]. After 2009, China's economy entered a period of decline, when enterprises in all provinces were looking for external demand and strengthening the expansion of foreign markets, which was greatly affected by external shocks to a certain extent.

Table 3 Regression results of time node samples

	2003~2008		2009~2017	
	From 2003 to 2008		From 2009 to 2017	
EPU	-0.0152	0.0195**	-0.0197**	-0.0491***
	(0.0113)	(0.0075)	(-2.45)	(-3.97)
_cons	0.0986**	0.1784***	-0.0629	0.1918***
	(0.0410)	(0.0022)	(-1.06)	(41.33)
Control variables	Yes	No	Yes	No
N	186	186	279	279
r2	0.5928	0.0375	0.5759	0.1673
F	14.7072	6.8336	25.1752	15.7783
p	0.0000	0.0139	0.0000	0.0004

Standard errors in parentheses, $^*p< 0.1$, $^{**}p< 0.05$, $^{***}p< 0.01$

V. Robustness Test

Given that the impact of macroeconomic uncertainty in the current period cannot be reflected in the economic development level in the same period in real time, so in this paper, the dependence on foreign trade are data lagging behind one stage, which to some extent reflects the judgments of provinces on the expected macroeconomic development in combination with the previous economic situation, and reflects the expected effect. Such dynamic panel data also alleviates the problem of model endogeneity caused by missing variables to some

extent.

As economic policies will affect the trade industry and thus the trade dependence of each province, trade dependence will also adversely affect economic policies, i.e. the increase and decrease of trade dependence may be accompanied by the dynamic adjustment of economic policies. Therefore, endogenous problems will appear in the model, resulting in biased estimation results. In order to solve the problem of reverse causality, this paper introduces tool variables into the original model for re-analysis. According to the principle of selecting tool variables, it is necessary to find a variable that is only related to the uncertainty of Sino-US trade policy, but not directly related to the foreign trade dependence of China's provinces. Therefore, in this paper, on the basis of drawing lessons from other literatures, the macroeconomic uncertainty of the United States, which is one stage behind, is used as a tool variable [7,16]. The empirical results show that the regression coefficient of each variable has no significant change.

VI. Conclusions and Policy Recommendations

As a whole, the economic policy uncertainty has a negative impact on the dependence on foreign trade of each province. The improvement of China's market economy system has prompted the adjustment of economic policies to be more in line with the market environment and the development of enterprises, and the dependence on external trade of various provinces has also been reduced, indicating that the adjustment of government policies in recent years has promoted the healthy and sustainable development of the economy, which is also a good signal for the market. At the same time, however, attention should be paid to avoiding "one size fits all" policy management. Instead, a differentiated and targeted regional governance structure should be implemented in combination with the economic characteristics of the eastern and central and western regions to construct the development of foreign trade industry in line with the region itself. For example, the central and western regions should maintain the advantage of backwardness and keep forging ahead from low-level industries to high-level industries. The eastern regions should focus on self-research and localization while reasonably guiding the development of industries, so as to reduce the control of certain areas by imported industries. Regarding the effect of policy implementation, in order to ensure that the market reform can be carried out in an orderly manner, attention should be paid to the laws of economic development cycle, not only to China's development cycle, but also to the financial development environment of the major economies in the world.

Since both increasing foreign direct investment and R&D investment have played a role in reducing dependence on foreign trade, China should selectively introduce the production of high-end technology industries to make up for the gaps in related fields. Moreover, under the background of economic globalization, all provinces should combine their local industrial advantages, capital advantages and resource advantages, pay attention to cultivating and supporting the development of local enterprises while introducing foreign capital, pay attention to the cultivation of scientific researchers and the research and development of high and new technologies, and constantly explore the top of the global value chain.

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