

# **The Impact of the Development Strategy of the Maritime Silk Road**

## **Abstract**

China's One Belt and One Road strategy has caught the attention of the world. The Maritime Silk Road of the 21<sup>st</sup> Century, a part of this strategy, involves numerous countries and regions as well as complicated sea/land connections, and its strong policy relevance makes it worthy of in-depth study by academia. President Xi Jinping announced in his October 3, 2013, speech to Indonesia's Parliament ("Construction Jointly the China-ASEAN Community of Common Destiny") that "China is more than willing to build the Maritime Silk Road of the 21<sup>st</sup> Century together with the ASEAN countries".

From the perspective of the transportation infrastructure in the Maritime Silk Road economic belt, we analyzed the economic indicators of regional economic integration. The paper has selected the 2005 to 2015 panel-data of 17 important cities in the Silk-Road Economic Belt and the Maritime Silk Road in China. It verified the influence of intercity transportation infrastructure in the economic belt on regional economic integration based on the gravity model into which the transportation density variables are added. The empirical results showed that the boundary effect value of the intercity trade in the Silk Road Economic Belt and the Maritime Silk Road is close to that of the inter-state trade of developed countries. The improvement of transportation infrastructure plays a positive boosting role in the regional trade. Such infrastructure increases the inter-city and regional trade and propels the regional economic integration.

By using the panel data of economic fluctuation and growth of 30 provinces from 1980-2013, specifically, the author examines how the capital formation, finance policy and money supply affecting economic growth fluctuations in China. The analysis used the panel-date approach of Vector Autoregressive modeling (PVAR) and the Impulse Response Functions (IRFs) and the Variance Decomposition. Empirically, according to the results, capital formation and economic policy fluctuation have important influences on economic growth. The influence is positive in the short term, but in the long term, it is negative and will be weakened.

**Key words:** gravity model; short-term volatility; boundary effect; regional economic integration; long-run growth; vector auto-regression; impulse response

# 1. Introduction

In order to indicate the origin of the historical background of the proposing of the Maritime Silk Road in 21<sup>st</sup> Century, the following background is worth mentioning.

## 1.1 Background

“Advancing the cause of building the Silk-Road Economic Belt and the Maritime Silk Road to form the situation of overall opening-up”, this slogans were raised in the Third Plenary Session of the Eighteenth Central Committee of China. Premier Li noted “planning and building the Silk-Road Economic Belt and the Maritime Silk Road” in the consecutive government work report. This shows the building of “Maritime Silk Road” has been a national strategy of China. 21<sup>st</sup> Century Maritime Silk Road not only in the sea routes from ports of China to ports of Southeast Asia, Southern Asia, Persian Gulf, Red Bay, West Bank of India, but also is international trade network constructed through cooperation mechanism between ports and cities along the Maritime Silk Road. The Maritime Silk Road crosses a wide area and contacts a large number of countries. Political and economic development level, historical and culture background of these countries are different. In this case, the building of the Maritime Silk Road is influenced by various factors. It is difficult to determine which factors are more important and should be considered preferentially for their complex relationship. It leads to lack of targeted in the process of developing programs of building the Maritime Silk Road.

The existing research about the Maritime Silk Road are little, and mainly in the following three aspect. Firstly, dealing with the definition, periodization, sea routes, and set sail ports of the Maritime Silk Road. Secondly, studying the economic and trade relationship between China and coastal states along the maritime silk road from the perspective of building the maritime silk road together. For example, Ma analysis the importance of the Maritime Silk Road to South East Asia, Chen discuss the economic orientation and the win-win pattern between China and coastal states, Chen proposes the strategic concept of building the 21<sup>st</sup> Century the Maritime Silk Road together. Thirdly, researchers are benefit to understand the Maritime Silk Road from various perspectives, but studies about influence factors and their structural relationship which directly related to the building of the Maritime Silk Road are rare.

## 1.2 Our Work

**Problem 1:** Refer the relevant data and analyze the historical background of the proposing of the Maritime Silk Road in 21<sup>st</sup> Century.

**Problem 2:** Choose a perspective and an industry to analyze the relevant economic indicators.

**Problem 3:** Establish a mathematical model to study the short-term impact of the

development strategy of the Maritime Silk Road on China or other countries.

## 2. Assumption

1. The space trade model is the dynamic basic of mathematical in the Maritime Silk Road.
2. The initial conductivity in every geographic position is estimated by self-generating condition from various regions.
3. The mainly investigational locations are production place and consuming place.

## 3. Symbol Description

Symbol	Description
$D_{ii}$	The intercity trade distance.
$S$	The area of city.
$HZ$	Freight turnover.
$Pgde$	GDP per capita
$Dis$	The distance between cities.
$X$	Transportation infrastructure
$Trade$	The variable of globalization
$Ind$	The variable of industrial structure
$Gov$	The variable of local financial final expenditure
$\varepsilon$	Error
$Z_{it}$	The $4 \times 1$ vector variable based on panel data.
$\lambda_0$	The $4 \times 1$ response variable in each province.
$\lambda_1$	The coefficient matrix of hysteresis of first stage.
$\lambda_2$	The coefficient matrix of hysteresis of second stage.
$f_i$	The vector of year effect.
$Growth$	Economic growth rate.
$Sd_{cf}$	The fluctuation of gross capital formation.
$Sd_{bd}$	The fluctuation of budget deficit.
$Sd_{cdze}$	The fluctuation of total loans.

## 4. Solution of Problem 1

### 4.1 History

As China was called the “country of silk” in the ancient times, the name “Silk Road” originated from the overland trade in Chinese silk to Europe or, via the South China Sea, from China’s shores to the coastal countries in the Indian Ocean. Although

these routes began 2,000 years ago, their academic concept came into being less than a century ago, held back by Euro centrism and China's backwardness in her modern history.

The risk of a nation's maritime power coincides with the expansion of its networked economic interests, as occurred during Western colonial expansion when fierce naval contention burgeoned after new sea routes opened. Mahan's theory stressed military sea power for security of trade routes and overseas interest, and in past centuries Spain, Portugal, England and the U.S. have protected trade with their naval might. Likewise, China's national strategy is bound to be adjusted as its demand for overseas resources and markets grows, but in contrast to Western colonial expansion, China while seeking its place as a sea power, advocates peace harmony, mutual benefits and cooperation.

China's Maritime Silk Road of the 21<sup>st</sup> Century is a new concept of maritime security that is intended to advance the construction of a new order based on free and open navigation, common security on the sea, and common development of marine resources, and is an endeavor to build a littoral economic belt through development cooperation.

In discussions about One Belt and One Road, offshore integration is stressed, in that China should "introduce an integrated institutional arrangement in such areas as production, currency, finance, trade, investment and labor to all those regions in the world that have great strategic significance to China's development and sustainable growth." Positive spill-over effects for other countries are obvious since China, now the world's leading manufacturing base, is looking to resolve its problems of production capacity. While this transfers China's excess production to its neighbors to guarantee sustainable economic growth, it also aids the economies in the region and strengthens economic cooperation.

Construction of the Maritime Silk Road will bolster the energy lifeline of Chinese economy, which is heavily dependent on tankers. China's phenomenal economic growth ties it more closely to the outside world, and "there is a strong structural dependency of China on international or regional economic systems in trade, investment, finance and institutions." Some Chinese scholars view China as having an "export-oriented economy that depends on the ocean passages." About 90% of China's exports go by sea. Crude oil, iron ore, copper ore, and refrigerated cargo are imported by maritime shipping, also. China's energy security is sea-dependent. Over 90% of crude oil (US\$199.168 billion in 2012) arrives by sea, 80% of that via

Malacca. Even in 2040, well over half of the country's oil will be imported. The two pipelines being built through Myanmar and Pakistan are not enough to replace the energy supply line from the sea. Super oil tankers enroute to the Southern Pacific that cannot go past Malacca have to pass through the adjacent Lombok Strait and Makassar Strait. To crack the Malacca Dilemma, China must expand maritime cooperation to ensure sea passages. These routes are essential and a reason why the Southern Pacific sea access is a priority.

The Maritime Silk Road will intensify China's positive economic interaction with foreign countries. Prior to China's reforms and opening up, and because of the grim international environment, China's economic layout was semi-closed, focused domestically with few outside economic links. Today, more than 30 years later, China's economy has moved "from attracting foreign investment to laying equal stress on both attracting foreign investment and going out, which has brought about a new situation of China's deep 'trio-merge' into the world in market, energy and other resources, and investment." For five consecutive years China has been ASEAN's biggest trading partner, for example. After the 1997 financial crisis, China-ASEAN economic cooperation boomed. In the 10 years between 2002 and 2012 China-ASEAN trade volume increased more than seven-fold and reached US\$400 billion. By September 2014, the aggregated two-way China-ASEAN investment was US\$123 billion, of that ASEAN countries invested over US\$90 billion to China. Currently, the two sides are engaged in the negotiations to upgrade the FTA and celebrate the Diamond Ten Years of their relationship. In South Asia and the Southern Pacific China's economic cooperation has grown quickly. Indian strategist Raja Mohan pointed out that "China's political and economic interests are no longer confined to the South China Sea" and expansion to the Indian Ocean "is a process of natural extension."

The Asian Infrastructure Investment Bank (AIIB) and the Silk Road Fund give priority to interconnection projects along the Silk Road. In addition, China is also setting up US\$10 billion in China-ASEAN loans for infrastructure.

The design of the Maritime Silk Road advocates mutual consultation, joint construction and shared results with the countries concerned, strengthening the interconnection on the sea, and creating a beneficial external environment for the security and safety of the maritime passage by constructing communities of common interests and common destiny.

## **4.2 Peace and Prosperity**

The Maritime Silk Road proposed by China is the road to peace and prosperity, based on mutual consultation, joint construction and sharing the results together with the countries concerned, which is a great philanthropic act for China and countries or regions. Construction and security of the Maritime Silk Road must counter the gaming over the maritime order among big powers, disputes over maritime rights and interests, governance of the countries involved, and non-traditional security threats on the sea.

Firstly, the construction of the Maritime Silk Road may arouse concerns and misgivings of the existing sea powers. Although the Maritime Silk Road advocates a more equitable maritime order and an ocean theory of peace, cooperation and harmony, the U.S., to safeguard its maritime hegemony, is likely to rankle over China's construction of the Maritime Silk Road. In addition, as the Maritime Silk Road also involves the Indian Ocean, Indian is rather dubious of China's true intention behind the Maritime Silk Road Strategy. These are the strategic challenges needed to be dealt with properly in the construction of the Maritime Silk Road.

Lacking mutual trust in security with China, people in India worry that China is building a "string of pearls" to encircle their country, with some scholar from the strategic circle believing that "confrontation at sea between China and India cannot be avoided" and "China is India's biggest rival in the Indian Ocean." This anxiety has led to India strengthening its military diplomacy and its dominance over the Indian Ocean. Beijing could view this as attempts "to block China from entering the Indian Ocean." After Sri Lanka, Maldives, Pakistan, and other countries expressed willingness to be involved in the Maritime Silk Road's construction, India's worries increased. Jabin Jacob Thomas, of the Indian Institute for Chinese Studies, noted that while the One Belt and One Road strategy brings enormous opportunities for China and India, India is concerned "to what extent China would recognize India's historical role and influence in the region involved in 'One Belt and One Road'" and India's vital sea-land interests. As revealed by Indian press, the Modi administration intended to start a project code-named "Project Manusam" to "compete with China's Maritime Silk Road."

Secondly, the upgrading behavior without scruple of some parties involved in the South China Sea dispute may get in the way of the China-ASEAN pragmatic cooperation. As ASEAN is the first and most important stop in the construction of the "Maritime Silk Road." It is of great importance to get the support and participation of the ASEAN member states for the smooth advancement of the "Maritime Silk Road."

Currently, China has generally enjoyed good relations with ASEAN and its member states, and the leaders of the ASEAN countries “appreciated the initiatives China has proposed to build the China-ASEAN Community of Common Destiny” and jointly construct the “Maritime Silk Road” of the 21<sup>st</sup> Century, and at the same time both sides are exploring the possibility of signing a “treaty on good neighborliness and friendly cooperation.” The China-ASEAN relationship presents great opportunities, but Vietnam and the Philippines continue to provoke disputes over the South China Sea. China’s measure to safeguard her rights have been hyped as “maritime threats,” troubling to the China-ASEAN relationship.

## **5. Modeling Establishment and Solution of Problem 2**

The paper selected economic belt in the Maritime Silk Road as a research perspective, by calculating the boundary effect in the each sample cities which in economic belt, we analyzed the relationship among the transportation infrastructure and intercity trade, we also tested the actions of transportation infrastructure development in west development strategy, and to verify whether the influence of inter-regional trade could promote regional economic integration.

Currently, the desire of importance of international cooperation in the Maritime Silk Road development continues to strengthen, the relationship research between concern study transport infrastructure and regional economic coordinated development is deepening continuously. Therefore, a kind of empirical approach was taken to verify the accuracy of test experience, studied the relationship between transportation infrastructure and regional economic integration in Maritime Silk Road, which has important practical significance.

In regard to the research methods in transportation infrastructure which promote regional economic integration, we considered theoretically that the improved transportation infrastructure which could reduce the region's trade costs and promote market scale to be enlarged and the formation of specialized division of labor, which would improve the efficiency of regional trade, so the improvement of transportation conditions may have an important role in promoting regional economic integration. Behrens<sup>[1]</sup> proposed the unequal relationship in the argument transportation infrastructure, international economic integration and regional economic, the international trade volume depends on the level of transport costs, countries which have a good transport conditions are tended to obtain high share of international trade flows, which are more likely to promote the balanced development of regional economy.

## 5.1 The Budget of Regional Economy Integration

Through looking up available literature, trade flows are an ideal target to measure regional economic integration, we selected the Maritime Silk Road economic belt in 17 samples of various types of urban transport modes' freight turnover as trade flow indicator, the time span was from 2005 to 2015, measuring trade situation in intercity economic belt. Explanatory variables have per capita GDP, the distance of intercity and transportation infrastructure. Because the distance of intercity trade is related to urban area. Therefore, we adopted the following formula to estimate the distance of intercity:

$$D_{ii} = \sqrt{\frac{S}{\pi}} \quad (1)$$

To test the robustness of the results of parameter estimation, the model included three control variables: total volume of import and export trade share of GDP accounted for the proportion of the global variables (*Trade*), the number of practitioners which in the first and secondary industries accounted for the proportion of the labor force of industrial structure variables (*Ind*), and the local government financial accounts of fiscal expenditure in current year which accounted for local financial accounts of GDP expenditure accounts variables (*Gov*), taking into account the impact of local price, The variables above made inflation reduction process in accordance with constant prices in 2004, the descriptive statistics of variables are as table 1 shows.

**Table 1** The descriptive statistics of variables in the Maritime Silk Road

Variable	Sample size	Mean	Variance	Minimum	Maximum
<i>HZ</i>	204	395.43	1156.27	258.30	8919.01
<i>Pgdp</i>	204	15821.26	897.31	7494.81	29524.48
<i>Dis</i>	204	1771.14	947.11	125.38	2236.67
<i>X</i>	204	76.14	45.23	4.89	335.77
<i>Trade</i>	204	0.31	0.39	0.03	1.41
<i>Gov</i>	204	0.21	0.16	0.10	0.89
<i>Ind</i>	204	0.67	0.11	0.31	0.77

## 5.2 The Border Effects Model within Transportation Infrastructure

In order to analyze the impact of transportation infrastructure to intercity trade in the Maritime Silk Road economic belt, we attempts to add the variable of transportation infrastructure into gravitational model, the model is:

$$\ln Trade_{ij} = \alpha_0 + \phi D + \gamma A + \alpha_1 \ln GDP_i + \alpha_2 \ln GDP_j + \alpha_3 \ln Dis_{ij} + \alpha_4 \ln X_{ij} + \varepsilon_{ij} \quad (2)$$



In formulate above,  $X_{ij}$  means the average level of transport infrastructure from region  $i$  to region  $j$ . This formula means that when the average regional trade of transportation infrastructure increased by 1%, the total bilateral trade (the sum of intra-regional trade and intercity trade) would increase by  $\alpha_4\%$  in average. If the  $X$  coefficient  $\alpha_4 > 0$ , it is indicated that the improving of transportation infrastructure to the total volume of trade has a positive role in promoting.

### 5.3 Empirical Analysis

The endogenous of explanatory variables can lead to the deviation of parameter estimation. On account of transportation infrastructure born in economic growth due to the endogeneity, the eastern areas' level of economic is developed in the Maritime Silk Road economic belt, which causing a rapid increase in the development of transportation infrastructure and intercity trade. The trade-oriented economy prone to develop transportation infrastructure catalytically. So, we need suitable methods (instrumental variable method) to solve this endogenous problem. Exogeneity and endogenous potential explanatory variables are highly correlated premise which is the premise to choose suitable tool variables. In view of the development of government preferential policies and transportation infrastructure which are highly relevant, in this model, we built coastal open areas and other preferential policy indexes, and we regarded the transportation infrastructure variables as exogenous variables.

The estimated results of empirical model show that: Model1 is the standard gravity equation; Model2 is the gravity equation which based on the introduction of transportation infrastructure variables; Model3 is the boundary effects model; Model4 is the boundary effects model which based on the introduction of transportation infrastructure variables.

**Table 2** The transportation infrastructure of estimated gravity equation

Model Explained variable Method Explanatory variable	Model1	Model2	Model3	Model4
	lnHZ	lnHZ	lnHZ	lnHZ
	OLS	IV	OLS	IV
lnPgdp <sub>i</sub>	0.4421	1.1124	1.2553	0.9925
lnPgdp <sub>j</sub>	0.5224	0.3354	0.5647	0.5542
Indis <sub>ij</sub>	2.9544	1.2217	1.3691	1.2275
lnX <sub>ij</sub>	1.8740	1.7560	1.9925	2.0041
D	2.3558	2.2745	2.9882	2.9921
Adj	2.0087	1.5548	1.8992	1.8999
Constant	-2.1140	1.2275	0.9928	0.8846
F-Statistics	89.3211	64.3421	35.6214	67.8944
Sargan Test	0.4579	0.5432	0.6612	0.6972

Border Effect	17.3226	15.8543	18.6540	18.9522
Adjacent Effect	5.6772	3.8991	7.9822	8.0235
Observations	203	203	203	203
R <sup>2</sup>	0.9501	0.9745	0.9136	0.9355

Test results in table 2 show that: **F** value of the first phase were greater than 10, which means there is a high correlation between the selected tool variables and endogenous explanatory variables. The probability value of Sargan<sup>[2]</sup> test is greater than 0.1, indicating that there is no excessive tool variables identification problem. That is, the selected tool variables in text are valid.

The results of estimation in table 2 are match with the expected gravity equation above, the effect of economy scale in intercity bilateral trade is positive, the effect of the distance between the two cities in intercity trade is negative, and the regression results have passed the level of 5% significance test. It is showed that the gravity model should be chosen to analyze the problem of intercity trade in the Maritime Silk Road economic belt.

The construction of transportation infrastructure can facilitate factors of production in the countries' agglomeration and diffusion. The poor transportation could cause market segmentation and trade blocked. Transportation infrastructure as a social advance capital, the Chinese government has been always attaching great importance to the "transportation, top priority" of the western development policy<sup>[3]</sup>, as well as the introduction of 4 trillion investment in transportation infrastructure program at the end of 2008, to promote China's fast-growing traffic density. Test results in Table 2 show that: the transportation infrastructure in economic belt has a significant positive impact on the intercity trade, the development of the transportation industry has promoted an increase in inter-city trade.

#### **5.4 Intercity Boundary Effect Estimation**

To clear the implemented method that transportation infrastructure in the Maritime Silk Road economic belt promotes a positive role to trade, that is, whether through intercity trade to realize the target. If the transportation infrastructure cause an accumulation trade of a certain area, but it does not realize the intercity trade, which would run counter to the goal of achieving regional economic integration. If the transportation network can promote the transfer of intercity between space and logistics effectively, then the gap between the economic developments of the intercity inherent differences of resource in economic belt is shrinking gradually by the flow of production factors and the optimization of allocated resources<sup>[4]</sup>. Currently, the border

effect is an ideal index to estimate regional economic integration, through the actual estimates, verifying the transport policy in transportation infrastructure which in the rapid development of economic belt and the way of affecting the regional economic integration and the size and degree of development of the country would to be more explanatory power.

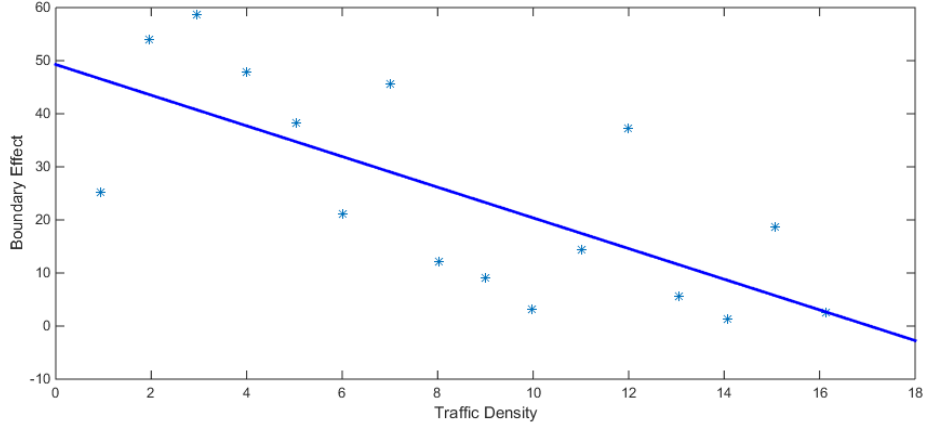
In order to estimate the relationship of transportation infrastructure and border effects, we used tool variable method, taking estimation model (2) to estimate the effects of economic belt boundary of each of the selected sample cities, it is estimated that the value was shown in table 3.

**Table 3** The cities of estimated Border effects in Maritime Silk Road

Region	Estimated value	Boundary effect
Urumchi	3.0062	25.6331
Zhangye	4.2104	54.3542
Weiwei	4.3641	59.6623
Xining	4.0018	48.2147
Yinchuan	3.2566	37.0080
Lanzhou	2.6878	19.9241
Tianshui	3.9984	45.3398
Baoji	1.9954	11.3219
Xianyang	1.9532	10.2541
Xian	0.3874	3.2557
Weinan	2.3911	13.5003
Sanmenxia	3.9534	37.3983
Luoyang	1.6873	4.6637
Zhengzhou	0.6587	2.0019
Shangqiu	2.9935	18.2281
Jinan	0.3327	1.4682
Rizhao	0.2559	0.8009

### 5.5 The Relationship of Transportation Infrastructure and Boundary Effects in the Maritime Silk Road Economic Belt.

According to the statistical, in the value of estimated boundary value. The correlation coefficient of the Maritime Silk Road economic belt and transportation infrastructure was -0.3843, through the test of 1% significance level. Combining the significant downward tilt phenomenon of regression trend line in scatterplot (Fig.1), and it is illustrated that the existence of a significant negative correlation between the traffic density of economic belt and boundary effects<sup>[5]</sup>, namely, the development of the transportation infrastructure in economic belt can improve the foreign trade situation in the region, and promote local economic integration with other areas.



**Fig. 1** The relationship of traffic density and boundary effect in the Maritime Silk Road

## 5.6 Empirical Analysis of Transportation Infrastructure to the Effect of Boundary in the Maritime Silk Road

To test the robustness of the negative relationship of traffic density and boundary effects in economic belt, we need to add other control variables to take regression test, the model is:

$$\ln EB = \phi = \alpha + \beta \ln X + \sum_{i=1}^k \gamma_i X_i + \varepsilon \quad (3)$$

In formulate above,  $BE$  means boundary effects,  $X$  vector included five control variables: per capita GDP ( $Pgdp$ ), global variables ( $Trade$ ), dual structure index (the first, second industry population take the gravity of total labor force) ( $Ind$ ), local financial accounts of expenditure ( $Gov$ ) and dummy variables, the eastern section in economic belt as a reference, controlling the effect of West border effects in western region. The empirical results show (Table 4): the traffic density ( $X$ ) in economic belt and boundary effects ( $BE$ ) have a significant negative correlation, which is consistent with the theoretical findings. This conclusion also indicates that the traffic density on the expansion of import and export trade in economic belt, promoting the exchanges in intercity trade, namely, the improvement traffic density in economic belt, reducing the cost of transportation, speed up the spatial mobility of production factors, and promoting the region economic integration.

The result of other variables which affecting boundary effects ( $BE$ ) show that global variables ( $Trade$ ), dual structure index ( $Ind$ ) which is significantly negative to the impact of  $BE$ ; per capita GDP ( $Pgdp$ ) and local fiscal expenditure accounts ( $Gov$ ) have a inconspicuous impact on  $BE$ .

This shows that per capita GDP ( $Pgdp$ ) has a large areas of goods export capability, it has an low level of duality, local trade capacity is also strong, so the

impact of the variables on the boundary effects (*BE*) is not obvious. In globalization indicators, the boundary effects of the proportion of total import and export trade (*Trade*) is lower than major area. The eastern coastal city in economic belt which linked to coastal developed areas, which has high opening degree, which has dominant transportation infrastructure, which has enrichment of production factors, market conditions catalyze the rapid growth of local trade, and the spillover of transportation infrastructure space spillovers effective factors also contributed to the high volume of international trade. The local governments in order to optimize the development of investment environment, and promote the rapid growth of the local economy, on the investment and development of basic measures which has become one of the important initiatives of local government. In some foreign capital to build infrastructure which promoting the development of regional economic integration, but to help local industry with rapid development is easily led to the detriment of local protectionism, which is harmful to form regional economic integration. Thus, the local fiscal expenditure accounts (*Gov*) has little impact on boundary effects (*BE*).

**Table 4** The effect of traffic density to boundary effects in Maritime Silk Road

Model Explained variable Method	Model1	Model2	Model3	Model4
Explanatory variable	lnBE OLS	lnBE IV	lnBE OLS	lnBE IV
lnX	-0.2987	-0.2335	-2.0089	1.0297
Pgdp	0.51442	0.4003	0.5887	0.1184
Trade	-3.2576	-3.2954	-3.3355	-3.5589
Gov	0.2885	0.4338	-2.9947	-0.0253
Ind	-0.3588	-1.5573	-3.5541	-1.0089
West	0.8821	0.5468	0.1443	0.6424
Constant	8.7656	8.8664	9.6324	6.9873
Observations	17	17	17	17
R <sup>2</sup>	0.9682	0.9699	0.8932	0.9864

## 6. Modeling Establishment and Solution of Problem 3

According to the panel-date approach of Vector Autoregressive modeling (PVAR) and the Impulse Response Functions (IRFs) and the Variance Decomposition to study the short term impact on the China Maritime Silk Road Development Strategy, and we come up with rationalization proposals in the future development of China's economy.

In the short term, there is a certain degree of volatility in the economy itself, this volatility on the one hand from the economy itself, on the other hand from the government's macroeconomic policies, so that the Maritime Silk Road can

significantly affect the total output in the short term, and can also affect long term economic volatility.

It is controversial that government to adopt appropriate policies or to let the market through self-regulation mechanism to ensure sustained and stable economic growth. That is, when the economy in recession, whether through the Maritime Silk Road and other measures can be taken so that the economy can recover and stable development momentum. Therefore, this article three variables selected mainly from the following three aspects, namely: capital formation, fiscal policy and monetary policy.

Firstly, the volatility of the formation of total capital. The formation index of gross capital is a measure of the total amount in a given period of the formation of fixed assets and the increase in stocks, which represents the major internal economic fluctuations, which is the major measure of the effectiveness of the formation of current capital, meanwhile, it still has some impact on the next scale economic growth in the significance of economic, therefore, we took it into account. Secondly, the volatility of the budget deficit. This indicator of budget deficit can be attributed to government fiscal policy, which is an important variable to quantify the government's fiscal policy, we incorporate it into the model, which can explore the changes in government fiscal policy for whether it has significant effect in economic growth. Thirdly, the volatility of the size of loans deposit. The introduction of this total loans deposits variable which mainly to quantitate monetary policy, the variable should be used as a broad money, but due to this paper, which is adopted by provincial panel data, the data of broad money in each province which cannot be found, so it was instead by the total deposits and loans. Due to the size of deposits and loans shows the active status of the provinces in the region's financial markets, through this variable which we can see the impact of economic growth in the volatility of currency in the government's policy.

In this paper, we used variance decomposition method to explore the influence of the duration of the government policy, the results of the research is that the policy of the Maritime Silk Road which can affect total output in short-term significantly. In long term, this influence is decreased along with time gradually. Therefore, when the government formulates and implements the policy of fiscal and monetary, not only to consider the short-term effectiveness, but also to consider the long-term impact, choosing the best policy amplitude, and to achieve the best effects of policies.

## **6.1 Data and Method**

In order to control the degree of freedom effectively, we only selected four representative variables which among the model, we took four variables data in descriptive statistics, which is shown in table 5:

**Table 5** The main variables descriptive statistics

Variable	Mean	Standard deviation	Minimum	Median	Maximum	Number
<i>Growth</i>	0.09	0.05	-0.15	0.10	0.35	1020
<i>Sd_cf</i>	0.00	0.07	0	0.07	0.34	1020
<i>Sd_bd</i>	0.05	0.05	0	0.04	0.29	1020
<i>Sd_cdze</i>	0.50	0.39	0	0.43	1.90	1020

## 6.2 The Foundation of Model

In this paper, we adopted the construction of the panel-date approach of Vector Autoregressive (PVAR) model, we extended the traditional vector auto-regression (VAR) method to the field of processing panel-data (Panel Data), VAR took all system variables as endogenous, and panel-data is allowed the existence of unresolved individual differences.

We determined the lags to establish PVAR model, the determination of lags is very important to the model. If lags is too small, the residual error may be auto-correlational, and lead to the non-uniformity of parameter estimation, if lags is too large, many parameters were estimated, the degree of freedom would be reduced aggregately, which would have a direct impact on the effective estimation of the model parameters. We usually take the Akaike information criterion (AIC) to determine the lags of Panel-data. After operating on the data, we believe that the lag effect of the two periods is the best, the verbose output results was shown in table 6. When in lag second-stage, under the level of 90% confidence, AIC, BIC, HQIC have passed test, therefore, we selected two-stage lag.

**Table 6** The determination of lags

Lag time	AIC	BIC	HQIC
1	-10.899	-10.209	-10.636
2	-12.391	-11.601	-12.090

In the regression of PVAR model, we tested the regression of model's lags in a further move, the output results are shown in table 7.

**Table 7** The effective estimation results of PVAR to GMM

	First-stage lag	Second-stage lag
<i>Growth<sub>t-1</sub></i>	1.030	0.416
<i>Growth<sub>t-2</sub></i>	0.215	0.110
<i>Sd_cf<sub>t-1</sub></i>	0.440	0.318

$Sd\_cf_{t-2}$	-0.164	-0.218
$Sd\_bd_{t-1}$	0.310	0.357
$Sd\_bd_{t-2}$	-0.268	-0.314
$Sd\_cdze_{t-1}$	0.059	0.040
$Sd\_cdze_{t-2}$	-0.046	-0.011
N	960	930

From results above, in the first-stage lag, under the level of 90% confidence, the volatility of the budget deficit ( $Sd\_bd_{t-1}$ ) was not significant. In the second-stage lag, under the level of 99% confidence, in addition to the last two periods of lag growth volatility ( $Growth_{t-2}$ ) and the volatility of total loan ( $Sd\_cdze_{t-2}$ ), all variables can reject the null hypothesis, and they are significant, so we choose the period of second-stage lag. It was also carried out with the test match of lag above, indicating that the panel matrix estimation (GMM) is significant.

We considered the variables above and the test result of lag, we constructed the following model:

$$Z_{it} = \lambda_0 + \lambda_1 z_{it-1} + \lambda_2 z_{it-2} + f_i + e_t \quad (4)$$

In formulate above,  $z_{it} = (Growth, sd\_cf, sd\_db, sd\_cdze)'$  is the  $4 \times 1$  variable vector which based on panel-data,  $i$  means the different provinces,  $t$  means a particular year,  $\lambda_1$  and  $\lambda_2$  mean the coefficient matrix of the different variables in lag period,  $\lambda_0$  means the  $4 \times 1$  provinces effect vector (the constant),  $f_i$  is the effect of  $4 \times 1$  year vector.  $Growth$  represent the real increase rate of GDP,  $sd\_cf$  means the volatility of gross capital formation.  $sd\_db$  means the volatility of budget deficit,  $sd\_cdze$  means the volatility of total deposits, we brought these four macroeconomic variables into the same simulation systems, to analyze the impulse response in different provinces of the economic growth rate to different macro-economic variables.

When the VAR was applied to panel-data, and we need to bring some restrictions to VAR, considering each unit of cross-section, they have same underlying structure. Because of the limitation may be broken in the practical operation, there is a solution, that is, according to the way of introducing fixed effects which allows the difference in variables, they were manifested by  $f_i$  in the model. Thus because of the relevance of affected variable lags which caused the effect of  $f_i$ , which will be used to eliminate the traditional fixed effects "mean difference" to the estimation of the coefficients' bias error.

### 6.3 The Results of Model

According to the established model above, we calculated vector auto-regression



(VAR) on the panel-data. Thus, the output results of the panel matrix estimation (GMM) were shown in table 8 below.

The paper studied the short-term volatility of economic effects in the Maritime Silk Road, so the mainly observed data was the first column (1) in table 8, that is the explanatory power to the growth rate of economy ( $growth_t$ ) in the first-stage lag and the second-stage lag.

**Table 8** The main result of four variables in PVAR model

Explanatory variables	(1)First-stage lag		(2)Second-stage lag	
	(1) $growth_t$	(2) $sd\_cf_t$	(3) $sd\_bd_t$	(4) $sd\_cdze_t$
$Growth_{t-1}$	0.416	0.209	0.065	0.930
$Sd\_cf_{t-1}$	0.318	1.051	0.010	0.684
$Sd\_bd_{t-1}$	0.357	0.325	0.887	0.554
$Sd\_cdze_{t-1}$	0.040	0.024	0.000	0.880
$Growth_{t-2}$	0.110	0.235	0.065	0.565
$Sd\_cf_{t-2}$	-0.218	-0.170	0.051	-0.027
$Sd\_bd_{t-2}$	-0.314	-0.090	-0.079	0.172
$Sd\_cdze_{t-2}$	-0.011	0.008	-0.004	-0.081
N	930	930	930	930

Firstly, testing the feasibility of the model. From the table 8, under the level of 95% confidence, in addition to the growth rate of second-stage lag ( $growth_{t-2}$ ) and the volatility of deposits and loans ( $sd\_cdze_{t-2}$ ) this two variables in the model, and the **P** value of these two variables is greater than 0.05, and the **P** value of other variables are much less than 0.05. After the repeated verification of the author, this is the most relative efficient model, so the establishment of model is feasible.

Secondly, it can be seen from the regression results above, when the  $growth_t$  was interpreted as a explanation variable,  $sd\_cf$  (the volatility of the formation of total capital) has impact on  $growth_t$ , the first-stage lag  $sd\_cf$  has a positive impact on  $growth_t$ , and its coefficient is 0.318, so the results of the formation of the volatility of total capital in last year have a positive impact on economic growth in last year, namely, the greater the volatility of the formation of total capital, the pull of the current period of economic growth is greater. The second-stage lag  $sd\_cf$  has negative impact on  $growth_t$ , and its coefficient is -0.218, it is indicated that the formation of t capital in second-stage lag has a negative effect on the rate of economic growth. The first-stage lag  $sd\_bd$  (the volatility of budget deficit) has impact on  $growth_t$ , the first-stage lag  $sd\_cf$  has a positive impact on  $growth_t$ , and its coefficient is 0.357, it is indicated that the budget deficit in last year had a positive impact on the rate of economic growth, and the effect is relatively large, that the volatility of the budget deficit would have a huge impact on the rate of economic growth. The second-stage lag  $sd\_bd$  has a negative impact on  $growth_t$ , and its coefficient is -0.314, it is indicated that the volatility of second-stage lag budget deficit has a negative impact on the rate of economic growth.  $sd\_cdze$  (the volatility of deposit loans) has an impact on  $growth_t$ , and it is similar with the two variables above, the first-stage lag  $sd\_cdz$  has a positive impact on the rate of the economic growth, the second-stage lag  $sd\_cdze$  has a

negative impact on the rate of economic growth, but in terms of its coefficient values they were 0.040 and -0.011, the description of the first-stage lag and the second-stage lag  $sd\_cdze$  has a little impact on the rate of economic growth ( $growth_t$ ), at least it is not as good as the two variables above which have a huge impact on it.

In summary, from the view of coefficient, whether it is first-stage lag or second-stage lag, the size of the short-term economic impact on the Maritime Silk Road in China, and the order of the volatility of three variables is: the budget deficit > the formation of capital > the size of loan. Such results validated the mainstream view of the basic thought of Keynesian, which it is the government's fiscal policy and stable economic development of a significant effect, if the authorities can establish reasonable fiscal policy in accordance with the existing situation and it is possible to achieve stable development of real economic growth. At the same time, the output result is not able to draw on the money supply is the only important factor to cause instability in macroeconomic.

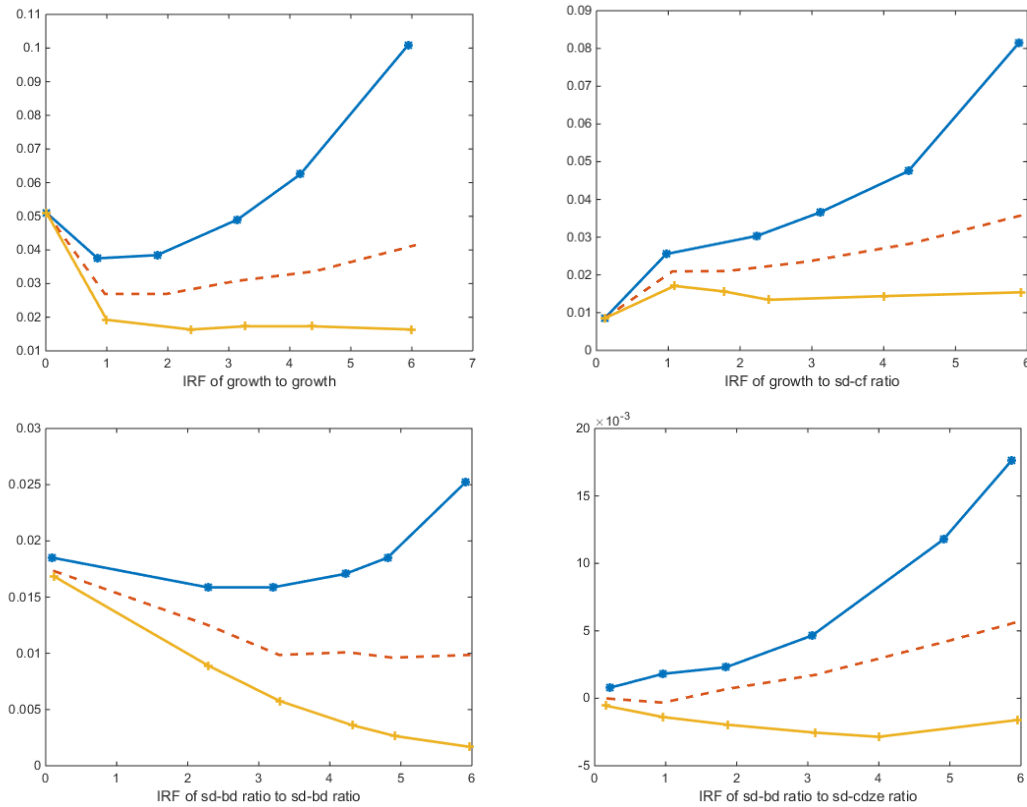
#### **6.4 The Impulse Response Pictures of PVAR Model**

It is difficult to explain the estimation of PVAR single parameter. In order to draw conclusions on PVAR model, which can observe impulse response function. Impulse response function provides us with the situation in other factors which are remain the same, studying the method of the dynamic effect of a factor which impacting on another factor, it can portray dynamic interaction effects intuitively, and judging the lag relationship between variables dynamically.

The advantages of the analysis of orthogonal impulse response function which can control the impact of other macroeconomic variables, to measure the response of a particular orthogonal information macroeconomic variables.

Because of the error of the variance-covariance matrix may be the non-diagonal matrix in formula (1), it is difficult to explain the error term in VAR system on impulse response function which is never completely uncorrelated, when the error term is related, they would have a common component, which they cannot be recognized by any particular variable.

We built the appropriate confidence intervals to analyze the impulse response function by using the coefficient of GMM and their variance - covariance matrix to generate lots of factors randomly, and re-calculating the process of shock response, the paper calculated 5000 times, to evaluate the impact of statistical significance of two standard error of confidence intervals through Monte Carlo simulation.



**Fig 2** The impulse response picture of four variables in second-stage lag

The output results of impulse response is the resultant force of the second-stage lag to the impact of economic growth, although in the second-stage lag, the regression result of PVAR show that, the volatility of the formation of total deposits, and the volatility of budget deficit, and the volatility of total loans and deposits, which have reversed impact of economic growth, and all values are small, it was shown at second-stage lag, the formation of capital and government policies have reversed and weak impact of economic growth. However, at the first-stage lag, the three variables have a huge impact on economic growth, although the second-stage lag impact is reversed, but all values are small, which cannot offset the positive impact on first-stage lag. For example, the volatility of the formation of total capital, the positive impact on the economic growth rate is 0.318 in first-stage lag, the negative impact on the economic growth rate is -0.218, the resultant action of two periods is 0.100, so the response of impulse response is still in horizontal line.

In summary, the output result of the panel-date approach of vector autoregressive modeling and the output result of the impulse response function are coincident, at the same time, confirming our initial anticipation. The formation of total capital and government policy has obvious significance in long-term economic growth rate, and this effect was weaken over time gradually.

## 6.5 Variance Decomposition

According to the contribution of variance decomposition which can affect the structure of the impact on macroeconomic variables, which constituted a further measure of the impact on economic growth rate. The output shown in table 9:

**Table 9** The variance decomposition result of PVAR

		<i>Growth</i>	<i>Sd_cf</i>	<i>Sd_bd</i>	<i>Sd_cdze</i>
<i>Growth</i>	3	0.972	0.016	0.007	0.005
<i>Sd_cf</i>	3	0.955	0.034	0.007	0.004
<i>Sd_bd</i>	3	0.918	0.013	0.065	0.004
<i>Sd_cdze</i>	3	0.947	0.020	0.007	0.026
<i>growth</i>	6	0.967	0.019	0.008	0.006
<i>Sd_cf</i>	6	0.967	0.019	0.008	0.006
<i>Sd_bd</i>	6	0.967	0.019	0.009	0.006
<i>Sd_cdze</i>	6	0.967	0.019	0.008	0.006

To correspond with impulse response graph above, the paper took 6 forecast period of variance decomposition, we selected the representative data which were in the third predictive period and the sixed predictive period to analyze.

In table 9, which shows the variance decompose results of the third predictive period and the sixed predictive period. As it can be seen, although the change of the economic growth rate was mainly due to itself, but the effect of the volatility of the third predictive period of the formation of total capital to the economic growth rate was 1.6%, the impact on the volatility of budget deficit was 0.7%, the volatility effect of the total deposits and loans was 0.5%. The effect of the volatility of the sixed predictive period of the formation of total capital to the economic growth rate was 1.9%, comparing with the third predictive period, the effect of the volatility of the sixed predictive period of formation of total capital has a great impact on economic growth rate, which is match to the output result of impulse response above. The effect of the volatility of in the budget deficit was 0.8%, the effect of the volatility of total deposits and loans was 0.6%. In addition, we can see the comparison of the data from the two predicted period of variance decomposition, the influence of the volatility of the economic growth rate has a trend of decline.

As we can be seen from the above results, there is a little effect on economic growth rate on three variables which are the volatility of the formation of gross total capital, the volatility of the budget deficit and the volatility of total loans and deposits, in contrast, the volatility of the formation of gross total capital and the volatility of budget deficit have a huge contribution to the economic growth rate, this conclusion

was also verified the conclusion of PVAR regression model above.

## **7. Conclusion**

### **7.1 Strengths**

1. Through relevant data and policies, we analyzed the historical background of the Maritime Silk Road in the 21<sup>st</sup> century, and elaborated the world economy and peace.

2. We analyzed the economic indicator of regional economic integration from the perspective of transportation infrastructure in the Maritime Silk Road. We established the gravity model which was based on gravitational traffic density, and we analyzed the improvement of transportation infrastructure has a positive role in promoting regional trade, the increases of transportation infrastructure promote the intercity and regional trade and regional economic integration.

3. Through the building of panel vector auto-regression (VAR), with the help of the impulse response function and the method of variance decomposition to study the short-term impact on the China development strategy in the Maritime Silk Road.

### **7.2 Weakness**

It is difficult to find the data that the Maritime Silk Road which affect other countries or regions, we just based on the data which in China's provinces among the Maritime Silk Road.

### **7.3 Improvement**

When optimizing the development of the Maritime Silk Road economic belt, we can also consider the plan of broken administrative division, local protectionism, strengthen human capital, increase the efforts of fiscal policy, improve the level of urbanization, optimize the investment environment, and standardize the market and other variables into the model to make the model more closer to the actual situation.

## **8. Reference**

- [1]YOUNG A. The Razor's Edge: Distortions and Incremental Reform in the People's Republic of China [J]. Quarterly Journal of Economics, 2000, 115(4):1091-1135.
- [2]PONCET S. Measuring Chinese Domestic and International Integration [J]. China Economic Review, 2003, 14(1):1-22.
- [3]FLEISHER Li H Z, ZHAO M Q. Human Capital, Economic Growth, and Regional Inequality in China [J]. Journal of Development Economics, 2010, 92:215-231.
- [4]Fatas A, Mihov I. Policy Volatility, Institutions and Economic Growth [J]. Review

of Economic and Statistics, 2013, (2):236-76.

[5]Yu W. How Business Cycle Volatility Affect Economic Growth in China?-An Empirical Study based on GARCH-M Model using the 1952-2012 Data [J]. Advance Journal of Food Science and Technology, 2014, (7):934-940.