The Study of Dynamic Effect Relationships between the E-Commerce, the Logistics and Economic Growth Based on the VAR Model

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Abstract

This paper establishes the vector auto-regression (VAR) model about the E-commerce, logistics and the economic output, uses the Eviews6.0 software, adopts the Chinese annual data from 2000 to 2012.It is studied that the relationships of dynamic effects between the E-commerce, logistics development and the economic growth through the Granger test and the variance decomposition. It is found that, in the long term the E-commerce development is the reasons of the Chinese logistics development and the economic GDP growth, while the economic GDP growth is not the reasons for the developments of E-commerce and the logistics. The development of logistics is not the E-commerce development and the economic GDP growth. The relationships of dynamic effect between the E-commerce, logistics and the economic growth are as follows, the development of E-commerce not only led to the development of the next logistics industry, it also effectively pull the next phase economic growth. The developments of E-commerce and the logistics industry together drive the China's next phase economic growth, the development's inertia of China's economic can also stimulate next period economic growth. At the same time, China's economic growth is also strong let the next phase the developments of E-commerce and the logistics industry.

Keywords: electronic commerce, logistics, economic growth, vector auto-regression (VAR) model

1. Introduction

E-commerce is quietly transforming the mode of global business, affecting the method of enterprise management, changing patterns of consumer's shopping, while the E-commerce is also becoming an engine of leading economic growth. E-commerce breaks the constraints of time and space, linked the parties of producers and consumers via the Internet, so that the whole process transactions are realized on the internet from the collecting transaction information, signing transaction contract to pay funds. Goods transport to the buyers with the fastest speed from the nearest warehouse. Compared with the traditional methods of transaction, E-commerce greatly shortens the time of transaction, reducing transaction costs, improve transaction efficiency.

In 2001 the Japanese government held the "IT development strategy meeting", and established the E-commerce development as the component of the most important strategies in Japan's economic development. Theoretical study of E-commerce also attracted wide attention from scholars [1].

2. Related Research

Domestic E-commerce research focuses on the E-commerce credit rating, consumer satisfaction, logistics, payment, tax administration and other micro areas, such as literature [2-6], study affect relationships between the E-commerce and economic growth is rare from a macro perspective. Even there are related research studies about the E-commerce promote economic growth, they are also still from micro perspective to illustrate the E-commerce promoting economic growth, such as the E-commerce is able to bring cost savings and the E-commerce can improve transaction efficiency. It is failed to give the dynamic relationships between the E-commerce development and the economic growth from the perspective of macro data.

As literature [7] use the China E-commerce and GDP data from the year 2000-2008, through set the E-commerce technology as an exogenous variable, directly put the E-commerce into the Douglas production function from the production point, thought that the E-commerce technology could improve the capital utilization efficiency and improve human resource utilization and stimulate the economic growth, reach the conclusion of E-commerce is a turning point of economic development and growth through empirical research [8].

Analyze the basic principles of the E-commerce promote economic growth from the demand point, use the data of China's GDP from year1997 to 2009 as the dependent variable, use the number of Internet users, the number of E-commerce domain names, and the number of E-commerce enterprises, number of online shopping and the E-commerce transactions and other variables as automatic variables. Conducted a correlation analysis and regression analysis, empirical studies the affect relations between the electronic commerce and the economic growth. But the regression results shows that the E-commerce transactions impact on the GDP is negative, at the 5% significance level, this effect relationship was not significant.

Literature [9] from the microscopic point proposes that the E-commerce could reduce transaction costs from the five aspects and improve economic efficiency, and ultimately contribute to economic growth. Further, use the changing Douglas production function empirical study the E-commerce affects on the economic growth, and found that the E-commerce impact on economic growth has significant role in promoting [10].

Thought that the contributions of the E-commerce promote the economic growth is the combine of the Human resource, RD and capital to promote technological progress, and promote the economic growth based on the institutional innovation. Empirical studies have found: When the lower level of economic growth, the lower the efficiency of E-commerce; when the higher level of economic growth, the higher the efficiency of E-commerce.

Literature [11] study the relationship between the B2B (Business to Business) E-commerce transactions and GDP applied cointegration test, Engle-Granger test. Found that there is not exist long-term and stable cointegration relationship between the B2B E-commerce transaction volume and GDP, GDP growth is caused the reason by B2B transactions, but GDP is not the cause of the B2B transaction volume increase.

Literature [12] constructs the corresponding bi-variable VAR model using the data of logistics industry and E-commerce development in Beijing from2001 to 2011, it is found that E-commerce is the Granger cause of the development of the logistics industry, and there are long-term co-integration between the E-commerce development and the development of the logistics industry.

Foreign studies of the relationship between E-commerce and economic growth have two types of research methods. A type of studies use input-output estimation methods, data are mostly use B2B and abroad GDP data, such as: In 2000, Martin Brooks and Zaki Wahhaj

(2000) used the MULTIMOD model (multi-regional econometric models) to estimate the affect of the B2B E-commerce to the macroeconomic in the U.S., Japan, Germany, Britain and France [13]. Approach is: First, gained B2B E-commerce procurement cost savings vendor or industry data in some selected industry sectors, and estimate the decline in the price level of other industries projected using input-output values, and then estimates the overall impact on the economy using multi-regional econometric B2B E-commerce model. It concluded that the B2B E-commerce will lead to an annual GDP increase at 0.25% in the above five countries on the basis of the original during 2001 to 2010.

November 2002, the Cisco Systems (www.netimpactstudy.com) shows that from 1995 to 2010 period the U.S. productivity growth from an annual average of 1.2% to 2.1% due to the popularity of E-commerce. From 2000 to 2010, the E-commerce made the EU average productivity growth from 0.3% to an average annual of 1.7%. The used method is the computable general equilibrium model (CGE) to assess the impact of the electronic commerce on the developing countries. CGE model is a general equilibrium model to clarify and resolve common method; the equilibrium model could obtain the final measurement results based on the adjustment price of factor market [13].

An other type of researches are that E-commerce Impact on the economic organization, and other factors of production, qualitative build that the E-commerce impact on the output of economy, product efficiency and other macroeconomic indicators, such as literature [14] systematic analysis the affects of E-commerce on the outputs of U.S. economy, point out that E-commerce will increase the outputs of the U.S. economy and reduce inflation [15]. literature think that E-commerce change the competitive element, generate new economic growth point, to promote economic growth, by changing the way of social organization of production, reduce the environmental pollution and improve the situation of asymmetric information. Literature [16] thinks that the E-Commerce has affected the global economy in many different ways. First of all, it has affected the information technology, and all the economic sectors, and most importantly, E-commerce has enhanced the productivity growth worldwide. The impact of E–commerce on developing countries could be even stronger than that on developed countries. Because the scope for reducing inefficiencies and increasing productivity is much larger in the developing countries. literature review the issues relevant to the impact of E-commerce on international trade and employment [17]. New jobs will be generated in the information and communication technologies sector, while the indirect creation of jobs will occur via increased demand and productivity. At the same time, some reallocation and destruction of jobs are expected as a consequence of changes in the way of doing business E-commerce. The net effect on employment will be the resultant of a complex set of interactions and will by no means be uniform across countries, geographic areas, industries or skill groups.

3. **Research Methods and Data Sources**

This paper uses the annual level of GDP in China from 2000 to 2012 as a measure of economic value. 2000-2011 GDP data comes from "China Statistical Yearbook," 2012 annual GDP values obtained through the exponential smoothing method. The E-commerce use E-commerce transactions, the data of E-commerce transactions from 2000 to 2007 comes from Sina news, the data of E-commerce transactions from 2008 to 2011 from http://www.iresearch.cn/, 2012 E-commerce transaction volume data comes from Baidu library.

The data of logistics from 2006 to 2012 comes from "The Courier Industry Report of China in 2009" and "The Courier Industry Report of China in 2012"[①], using the revenues of above-scale courier service enterprises during this period. Because the missing data from 2000 to 2005, the data is calculated using an exponential smoothing method during this period.

This paper uses the Eviews6.0 software to build a vector auto-regression model (VAR), studies the dynamic effects relationship between the E-commerce transactions, logistics revenues and the level of economic output though the data stationarity test and Granger test and variance decomposition.

To make sure the data comparable, the product GDP value divided by GDP deflator as the base year of 1978, adjusted to the values of 1978 price. In order to avoid heteroscedasticity, get its logarithm, denoted lngdp. The E-commerce trading volume divided by retail commodity price index as the base year of 1978, also adjusted to the values of 1978 price, in order to avoid heteroscedasticity, get its logarithm, denoted lntr. The revenues of logistics industry divided by retail commodity price index as the base year of 1978, also adjusted to the values of 1978 price, denoted lnlg.

4. The Model

4.1. Establish the Vector Auto-Regression Model

There is not the full theory about the affect relationships between the E-commerce, the logistics and the economic development, In order to excavate the dynamic effects between the Chinese E-commerce, the logistics and economic growth, establish the vector auto-regression model between the level of E-commerce development, the logistics development and the level of economic fluctuations. In the simulation vector auto-regression model between the lntr, lnlg and lngdp, determining the number of lags are according to the AIC and SC Information Standards. Establish an order vector auto-regression model between the lngdp, lnlg and lntr. The Vector Auto regression Estimates are as the Table 1.

Table 1. Vector Auto Regression Estimates

Vector Auto regression Estimates
Date: 11/24/13 Time: 15:33
Sample (adjusted): 2001 2012
Included observations: 12 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNGDP	LNTR	LNLG
LNGDP(-1)	0.797645	0.422481	0.519450
	(0.05364)	(1.28319)	(1.93114)
	[14.8690]	[0.32924]	[0.26899]
LNTR(-1)	0.038590	0.853627	0.390601
	(0.00884)	(0.21152)	(0.31832)
	[4.36415]	[4.03575]	[1.22706]
LNLG(-1)	0.015852	-0.071441	0.343412

[①] The Research Center of Shuiqingmuhua , Research Report of China's Express DeliveryIindustry 2009 and 2012
    http://www.pday.com.cn

	(0.01010)	(0.24150)	(0.36344)
	[1.57016]	[-0.29582]	[0.94489]
C	1.437327	-2.251528	-5.384024
	(0.36984)	(8.84669)	(13.3139)
	[3.88632]	[-0.25451]	[-0.40439]
R-squared	0.999428	0.975364	0.930328
Adj. R-squared	0.999213	0.966126	0.904201
Sum sq. resids	0.000853	0.488078	1.105442
S.E. equation	0.010326	0.247001	0.371726
F-statistic	4657.137	105.5762	35.60788
Log likelihood	40.28251	2.185860	-2.719291
Akaike AIC	-6.047085	0.302357	1.119882
Schwarz SC	-5.885449	0.463992	1.281517
Mean dependent	7.265260	3.628043	-0.728216
S.D. dependent	0.368115	1.342034	1.200998

Determinant resid covariance (dof adj.)	5.39E-07
Determinant resid covariance	1.60E-07
Log likelihood	42.81858
Akaike information criterion	-5.136430
Schwarz criterion	-4.651524

The regression estimate representations are as formula (1-3). T statistic corresponding parameters are given in the below equation brackets, and then the following line shows the adjustment goodness of fit coefficients and the F statistic of equations.

From the results of model, the coefficients part of t-statistics is statistically insignificant in two estimated equations due to multi-collinearity between variables and it's lagged explanatory variables. It does not effect our theoretical analysis because that the main role of the vector auto-regression model is used to predict.

$$\ln gdp = 1.4373 + 0.7976 \ln gdp(-1) + 0.0386 \ln tr(-1) + 0.0159 \ln lg(-1) \qquad (1)$$

$$(t- \quad 3.886 \quad 14.869 \qquad 4.364 \qquad 1.570 \qquad)$$

$$\ln tr = -2.252 + 0.4225 \ln gdp(-1) + 0.8536 \ln tr(-1) - 0.0714 \ln lg(-1) \qquad (2)$$

$$(t\_ \quad -0.2545 \quad 0.3292 \qquad 4.036 \qquad -0.2958 \qquad)$$

$$\ln lg = -5.384 + 0.5195 \ln gdp(-1) + 0.3906 \ln tr(-1) + 0.3434 \ln lg(-1) \qquad (3)$$

$$(t\_ \quad 0.404 \quad 0.269 \qquad 1.227 \qquad 0.945 \qquad)$$

$$\overline{R}^2 = 0.99 \qquad F-statistic = 4657.137$$

From The results of the model, the results of each parameter's t test, because multi collinearity between the explanatory variables and their lagged variables, the parts of t statistics of estimated coefficients are not statistically significant in the three equations, the main role of vector auto-regression model is predict, which does not affect our theoretical analysis.

From the model it can be seen from the lngdp regression equation: lngdp changes mainly affected by its own lag one. Although the E-commerce transactions and the logistics revenues' changes impact the level of economic output lngdp is relatively weaker than itself of the level of economic output, then lagged ones of the E-commerce transaction and the logistics revenues affects the outputs of GDP are all positive.

It can be seen from the lnlg regression equation: lnlg changes mainly affected by the level of economic output and the E-commerce transactions, and the effects are all positive, the lag one of the logistics own affecting itself is positive, and it is weaker than the effects of the economic output and the E-commerce transactions.

It can be seen from the lntr regression equation: lntr changes mainly affected by its own lag one and the economic output, and the effects are all positive. The impact of logistics to E-commerce is weak, and the direction of impact is negative.

In other words, the development of E-commerce not only led to the development of the next logistics industry, it also effectively pulls the next phase economic growth. The developments of E-commerce and the logistics industry together drive China's next phase economic growth, the development's inertia of China's economic growth can also stimulate next period economic growth. At the same time, China's economic growth is also strong let the next phase the developments of E-commerce and the logistics industry.

Among the three variables of E-commerce, logistics and economic growth, beside the logistics development has a weak negative impact on the development of electronic commerce, any other variable changes in the three variables can positively influence another variable changes.

One reason may come from; E-commerce led to the development of the logistics industry, stimulating the demands of the society about the E-commerce-related IT, stimulating the investments of the society about information industry-related, thereby promoting economic growth. This Inspiration for the current practice of building our E-commerce is that encouraging and regulating the development of E-commerce market, stimulating the logistics industry development and growth, supporting innovations of related-information-technology, can effectively stimulate economic growth, enhance the upgrading of industrial structure, creating new employment opportunities related E-commerce industries.

Stability test for the above vector auto-regression (VAR) model is as follow Table 2, the results show that: the model is stable, dynamic regression model conclusions are valid.

Table 2. VAR Stability Condition Check

Roots of Characteristic Polynomial
Endogenous variables: LNGDP LNTR LNLG
Exogenous variables: C
Lag specification: 1 1
Date: 11/24/13   Time: 15:36

Root	Modulus
0.942041	0.942041
0.657938	0.657938
0.394706	0.394706

No root lies outside the unit circle.
VAR satisfies the stability condition.

4.2. Granger Causality Test

Firstly the variables are made the stationary test, using Eviews6.0 software, the serials of lngdp, lnlg, lntr and its first difference dlngdp, dlntr, lnlg as well as the second-order difference sequence ddlngdp, ddlntr are made the stationary test, use the ADF test.

From the test results it can be seen that the three sequences of lngdp, lnlg, lntr, and the first difference dlngdp, dlntr the ADF-t statistic at the 5% significance level are not significantly,

they are all not smoothy, but the ADF-t statistic of the first difference of dlnlg at the 5% significance level is significantly, the ADF -t statistic of the two second-order differential sequence ddlngdp, ddlntr at the 5% significance level are significantly, that is to say, the dlnlg, ddlngdp and ddlntr are stationary.

Secondly, make the Granger causality test for the lag one of lngdp lnlg and lntr, the test results see the Table 3.

Table 3. Granger Causality Test

Pairwise Granger Causality Tests
Date: 11/24/13   Time: 15:37
Sample: 2000 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNTR does not Granger Cause LNGDP	12	14.3526	0.0043
LNGDP does not Granger Cause LNTR		0.02768	0.8715
LNLG does not Granger Cause LNGDP	12	0.03629	0.8531
LNGDP does not Granger Cause LNLG		4.27770	0.0686
LNLG does not Granger Cause LNTR	12	0.00442	0.9484
LNTR does not Granger Cause LNLG		6.63528	0.0299

The results show that at the 5% significance level, the lntr is the Granger cause of lngdp, and the lntr is the Granger cause of lnlg, while the lngdp is not the Granger cause of lntr and the lnlg. And the lnlg is not the Granger cause of lntr. Because the sample size is limited only 12 objects, and the three series of lngdp, lntr and lnlg are non-stationary variables, the results of Granger causality test are reliable.

That in the long run, the growth of E-commerce transactions is the Granger cause of economic output growth, it is also the Granger cause of the logistics revenues growth. The economic growth is not the Granger causes of E-commerce development and logistics development. The logistics development is not the Granger causes of E-commerce development.

That the development of E-commerce will bring economic growth, is also result in the development of logistics. The developments of E-commerce and logistics are together promoting the economic growth. This also can be in-depth understanding the previous conclusions of vector auto-regression model, that is, E-commerce development is the long-term driving force of the logistics development and the economic growth.

4.3. Variance Decomposition

Make the variance decomposition of lag 10 for the variance lngdp, lnlg and lntr based on VAR model. It can be seen from the results of lngdp variance decomposition, lngdp fluctuations is affected only by itself fluctuations in the first phase period, later, The fluctuations of E-commerce transactions influence the changing of lngdp is growing, in the fourth period it is higher than the total influence of the lngdp and lnlg, it is reach 57.39%, after also growing, to finally it reaches the largest, accounting for 86.26%. The influence of lnlg to lngdp is 0 in the first period, it reach the maximum at 6.72% in the second period, then gradually decreases, final it is less than 1%.

It can be seen from the results of lngdp variance decomposition, in the whole 10 periods, lntr mainly affected by its own fluctuations. In the first period its own fluctuations reaches 99.1%, after declining, but the reduced proportion is small, in the last period the fluctuations as well as by its own is 98.41%. In the first period the fluctuations of lngdp to lntr is exist, nearly 0.9%, then gradually reduce, in the fourth period the fluctuations of lngdp to lntr is 0.55% , after growing again, and finally reaches a new height, close to 0.79%. The fluctuations of lnlg to lntr overall is weak , In the first period the fluctuations of lngdp to lntr is 0, In the second period the fluctuations is nearly 0.39%, after growing again, and finally reached the maximum, close to 0.81 percent.

It can be seen from the results of lngdp variance decomposition, fluctuations lnlg combined affected by lngdg, lntr and its own fluctuations in the whole 10 periods. In the first period it is affected by its own fluctuations, it reaches 60.5%, followed by decreasing, the fluctuations reach the minimum in the ten periods, it is 39.91%. The fluctuations of lngdp to lnlg are 19.53% in the first period, in the second period it reaches the maximum, close to 20.72%. Followed by decreasing, the fluctuations reaches the minimum in the ten periods, it is 14.77%. The fluctuations of lntr to lnlg is 19.97% in the first period, in the second period it reaches the minimum, it is 18.8%. Followed by increasing, the fluctuations reaches the maximum in the ten periods, it is 45.32%.

This is consistent with the model regression results.

5. Conclusion

This paper established the vector auto-regression (VAR) model about the E-commerce, logistics and the economic output, use the Eviews6.0 software, and adopt the Chinese annual data from 2000 to 2012. Through the Granger test and the variance decomposition to study the relationships of dynamic effects between the E-commerce, logistics development and the economic growth. It is found that, in the long term the E-commerce development are the reasons of the Chinese logistics development and the economic GDP growth, while the economic GDP growth are not the reasons for the developments of E-commerce and the logistics. The developments of logistics are not the E-commerce development and the economic GDP growth.

The relationships of dynamic effects between the E-commerce, logistics and the economic growth as follows, the development of E-commerce not only led to the development of the next logistics industry, it also effectively pull the next phase economic growth. The developments of E-commerce and the logistics industry together drive the China's next phase economic growth, the development's inertia of China's economic can also stimulate next period economic growth. At the same time, China's economic growth is also strong let the next phase the developments of E-commerce and the logistics industry.

This Inspiration for the current practice of building our E-commerce is that encouraging and regulating the development of E-commerce market, stimulating the logistics industry development and growth, supporting innovations of related-information-technology, can effectively stimulate economic growth, enhance the upgrading of industrial structure, creating new employment opportunities related E-commerce industries.

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