Analysis of the Current Situation of Yunnan-Laos Bilateral Economic Cooperation

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Abstract. This paper used ADF test, Johansen co-integration test and Granger causality test to prove that the GDP growth and Yunnan-Laos bilateral trade have a positive equilibrium relationship in the long run. The regression results also show that Yunnan's exports to Laos promote both economic growths which in turn expand bilateral trade further. It's expected that under the "One Belt, One Road" strategy, Yunnan-Laos bilateral trade will expand significantly.

1. Introduction

In the background of "One Belt, One Road" strategy, China's foreign trade has made further development. Laos is a developing country and borders on Yunnan province of China. It is a corridor for China to connect Southeast Asia. Yunnan, located in southwest China, is relatively backward province in economy. Bilateral trade between Yunnan and Laos has improved in recent years. There is a certain relationship between foreign trade and economic growth. This paper tries to find the relationship of Yunnan-Laos import, export and their influence on GDP of Yunnan and Laos respectively. It may help to know the motive and trend of Yunnan- Laos trade cooperation.

As the relation between trade and economy growth, Sautet (2007) [1] studies the opportunities and challenges faced by Laos in the China-ASEAN Free Trade Area. After the establishment of the China-ASEAN Free Trade Area, the Lao government has stepped up the implementation of free trade policy and the reform of foreign trade system.

Xiao Yang (2011) [2] studies the Yunnan- Laos border trade and analyzes the problems such as lag of infrastructure, unbalanced industrial structure, lack of competitiveness and policy inefficiency. It suggests that the two sides should increase the construction of infrastructure, accelerate the process of industrialization, strengthen the training of leading enterprises, and improve the corresponding trade policies. It provides a theoretical study on the healthy development of Yunnan border trade.

Gao Weiling (2014) [3] studies the development of the China-Laos economy and trade pattern, points out that Laos economy is based on agriculture and its industrial base is weak. After the reform and opening up, Laos economy has changed a lot. But compared with China, its effect is not obvious. The author makes a comparison between China and Laos in terms of trade and investment. Finally, this paper analyzes the economic and trade cooperation between China and Laos. China is the second largest trading partner, the largest import market and the fourth largest export market of Laos.

Yan Yaru (2015) [4] uses the quantitative methods to analyze the import, export and GDP of Yunnan province during 1981-2014. There is a one-way causal relationship between import, export and GDP, and import is the Granger cause for export. According to the actual situation of Yunnan, it suggests that Yunnan should strengthen its foreign trade, introduce new technology and equipment, and upgrade industrial structure.

In addition, there are some researches on the economic relations between China and Laos in the background of the regional cooperation such as China-ASEAN Free Trade Zone and Greater Mekong sub regional cooperation. Gao yilun (2009) [5] conducts an investigation from micro perspective in Luang Namtha province of Laos and Yunnan Province of China. In the face of opportunities and challenges to promote economic development, China and Laos should strengthen cooperation, eventually achieve a win-win situation.

There are numbers of scholars who have studied the foreign trade of China's economically developed areas or the bilateral trade of China and other countries. But there is few research on Yunnan's bilateral trade and its impact on economy. Moreover, the trade between Yunnan and Laos can directly reflect the effects of trade on their economic growth and provide an empirical basis forecasting trade between the two countries.

2. The Status Quo of Yunnan-Laos Bilateral Trade

Laos is a low-income developing country and adjacent to Yunnan. Laos is " One Belt, One Road " strategic partner of China. In recent years, the trade between China and Laos is expanding and so is Yunnan (Y) and Laos(L) (Table 1).

Table 1 Yunnan - Laos Trade and Economy (2005-2015, Billion USD)

Year	Total imports and exports	GDP of Y	GDP of L	exports (Y to L)	imports (Y from L)	exports growth rate (Y to L ,%)	imports growth rate (Y from L, %)
2005	0.042	50.170	2.736	0.029	0.013	—	—
2006	0.07	57.799	3.452	0.035	0.035	20.6%	158.6%
2007	0.083	69.167	4.223	0.036	0.047	32.3%	37.1%
2008	0.11	82.494	5.444	0.057	0.053	59.1%	12.3%
2009	0.155	89.417	5.833	0.074	0.081	30.1%	51.2%
2010	0.204	104.698	7.128	0.103	0.101	38.4%	25.1%
2011	0.266	128.886	8.261	0.104	0.162	1.1%	60.6%
2012	0.347	149.413	9.356	0.152	0.195	47.6%	20.1%
2013	1.049	171.483	11.189	0.727	0.322	378.3%	65.1%
2014	1.372	185.719	11.739	0.906	0.466	24.5%	47%
2015	0.882	197.379	12.369	0.318	0.564	-64.9%	20.4%

Source: Yunnan Statistical Yearbook, The World Bank Database.

The trade volume between Yunnan and Laos showed an increasing trend during 2005-2015. The trade volume in 2012 is $347 million, and in 2014 is $1 billion 372 million which increased by 4 times. Yunnan-Laos bilateral trade shows a trend of increasing year by year. In 2013, Yunnan's exports to Laos increased to $ 727 million, $ 906 million in 2014 which was the highest peak for historical exports. Although Yunnan-Laos import and export growth rates show a stable trend generally, they fluctuate in recent years. In 2013, Yunnan-Laos export growth rate reached 378%. Especially with the implementation of “One Belt, One Road” strategy, Yunnan-Laos bilateral trade increased significantly.

3. Analysis of Bilateral Trade Impacts on Economic Growth

3.1. Selection of Variables and Data Description

In order to know the Yunnan-Laos future trade cooperative wills, it is necessary to analyze the impact of Yunnan-Laos bilateral trade on GDP growth respectively. According to the world bank database, EPS database and the statistical yearbook of Yunnan province, this paper selects three indexes during 2005-2015, i.e. gross domestic product (*GDP*), exports (*EX*) and imports(*IM*). The three indexes include 6 variables: GDP of Yunnan (*YNGDP*), Yunnan exports to Laos(*YNEX*),

Yunnan imports from Laos (*YNIM*), GDP of Laos(*LWGDP*), Laos exports to Yunnan (*LWEX*)and Laos imports from Yunnan (*LWIM*). They are divided into two groups: Yunnan and Laos.

However, the data collected show that Yunnan's GDP is measured in RMB, while other data are measured in dollars. In order to unify the unit of measurement, according to the RMB exchange rate against the US dollar, the gross domestic product of Yunnan is divided by 6.9.

Take the GDP of Laos as an example, as shown in Table 1, Laos GDP data has a clear tendency. After taking the natural logarithm of the data, the trend of the data with time obviously weakened.

In order to minimize the heteroscedasticity of variance of the selected sequences, this paper takes the natural logarithm of each variable, using *LNYNGDP, LNYNEX, LNYNIM, LNLWGDP, LNLWEX, LNLWIM* to analyze, and then analyze the relationship between them by unit root test, Johansen co-integration test and Granger causality test.

3.2. Quantitative Analysis

3.2.1. Unit Root Test

The selected variables have certain time trend, so the research variables show the characteristics of non-stationarity. It may lead to "pseudo regression", i.e. without any economic relationship between the two variables and instability. It can also show a higher coefficient of determination. Therefore, it takes ADF test for *LNYNGDP, LNYNEX, LNYNIM, LNLWGDP, LNLWEX* and *LNLWIM*. The results are as follows:

(1) Yunnan Group

As can be seen from Table 2, *LNYNIM, LNYNEX, LNYNGDP* at 10% significant level of its ADF statistic values are greater than the critical value. It shows that the null hypothesis of the unit root cannot be rejected. So *LNYNIM, LNYNEX* and *LNYNGDP* are not stable and has a certain trend with time. Because *LNYNIM, LNYNEX, LNYNGDP* are not stable, they cannot be made regression analysis directly. After the first-order difference of the variables, the results of the ADF test show that the ADF statistic values are less than the critical value at the 5% significant level. Because the *DLNYNIM, DLNYNEX, DLNYNGDP* are stable and the same order sequences, it can use Johansen co-integration test to determine whether the *LNYNIM, LNYNEX* and *LNYNGDP* have a long-term equilibrium relationship.

Table 2 Results of ADF Unit Root Test

Variable	(C,T,K)	ADF Statistics	t-Statistic	Conclusion
LNYNIM	(C,T,0)	-1.703105	-2.7477*	Unstable
LNYNEX	(C,T,0)	-1.009482	-2.7477*	Unstable
LNYNGDP	(C,T,0)	-1.750780	-2.7477*	Unstable
DLYNWIM	(C,0,1)	-5.301746	-4.5826***	Stable
DNYNEX	(C,0,1)	-4.283341	-3.3210**	Stable
DLYNGDP	(C,0,0)	-3.248054	-3.2598**	Stable

Note: (1) D represents the first order difference of the variable; (2) * represents the critical value of 10% significant level, ** represents the critical value of 5% significant level, and *** represents the critical value of 1% significant level.

(2) Laos Group

As can be seen from Table 3, *LNLWIM, LNLWEX, LNLWGDP* at 10% significant level of its ADF statistic values are greater than the critical value. It shows that the null hypothesis of the unit root cannot be rejected. So *LNLWIM, LNLWEX* and *LNLWGDP* are not stable and has a certain trend with time. Because *LNLWIM, LNLWEX, LNLWGDP* are not stable, they cannot be made regression analysis directly. After the first-order difference of the variables, the results of the ADF test showed that the ADF statistic values are less than the critical value at the 5% significant level. Because the *DLNLWIM, DLNLWEX, DLNLWGDP* are stable and the same order sequences, it can use Johansen co-integration test to determine whether the *LNLWIM, LNLWEX* and *LNLWGDP* have a long-term equilibrium relationship.

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LNLWGDP	(C,T,0)	-2.031334	-2.7477*	Unstable
DLNLWIM	(C,0,1)	-4.283341	-3.3210**	Stable
DNLWEX	(C,0,1)	-5.301746	-4.5826***	Stable
DLNLGDP	(C,0,0)	-4.073401	-3.2598**	Stable

Note: (1) D represents the first order difference of the variable; (2) * represents the critical value of 10% significant level, ** represents the critical value of 5% significant level, and *** represents the critical value of 1% significant level.

Based on the test of the stationarity of the variables in Yunnan and Laos, the co-integration model is Equation 1 and *C* is constant.

$$LNGDP = \alpha LNIM + \beta LNEX + C \quad (1)$$

3.2.2. Co-integration Test

To the long-term equilibrium relationship among multiple variables, Johansen co-integration test is the main method of co-integration test. According to AIC and SC criteria to determine the optimal lag order of the VAR model, the lag order of Johansen is 0. Verified by Johansen's trace test, the results are as follows:

(1) Yunnan Group

From Table 4, it rejects the first null hypothesis and the second null hypothesis at the 5% significant level, and accepts the third null hypothesis. It is assumed that there are two co-integration relations between the three variables *LNYNGDP*, *LNYNIM* and *LNYNEX*. The main co-integration relationship after adjustment is shown in table 5:

Table 4 Results of Johansen Co-integration Test

Eigenvalue	Trace Statistic	0.05 Critical Value	Hypothesized No. of CE(s)
0.972744	69.53631	35.19275	None *
0.920230	33.51156	20.26184	At most 1 *
0.560690	8.225504	9.164546	At most 2

Note: * indicates rejection of the null hypothesis at 5% significant levels.

Table 5 Results of Standardized Co-integration

1 Co-integration Equation(s):		Log likelihood	13.58973	
Normalized co-integration coefficients (standard error in parentheses)				
LNYNGDP	*LNYNIM*	*LNYNEX*	*C*	
1.000000	-0.586157	0.109258	-6.759383	
	(0.03260)	(0.02944)	(0.01351)	

Co-integration Equation:

$$LNYNGDP = 0.10926 LNYNEX - 0.58616 LNYNIM - 6.7594 \quad (2)$$

(0.02944) (0.03260) (0.01351)

From Equation 2, the coefficient of *LNYNEX* is 0.10926 which indicates that the exports have positive effect on Yunnan's economic growth. It shows that Yunnan's exports to Laos increased by 1% will make Yunnan's GDP grow by 0.11%. While the coefficient of *LNYNIM* is -0.5862, which shows that the imports have a negative effect on the Yunnan economy. Yunnan’s imports from Laos increased by 1% will make the GDP of Yunnan decreased by 0.59%. And in terms of the absolute value of the coefficients, the negative effect of imports is greater than the positive effect of exports

on Yunnan's economy. The above co-integration equation is in line with the general principles of macroeconomics, that Yunnan's exports can bring growth to the GDP of Yunnan.

(2) Laos Group

From Table 6, it rejects the first null hypothesis and the second null hypothesis at the 5% significant level, and accepts the third null hypothesis. It is assumed that there are two co-integration relations among the three variables *LNLWGDP*, *LNLWIM* and *LNLWEX*. The main co-integration relationship after adjustment is shown in Table 7.

Table 6 Results of Johansen Co-integration Test in Laos Group

Eigenvalue	Trace Statistic	0.05 Critical Value	Hypothesize No. of CE(s)
0.962064	58.20035	35.19275	None *
0.853350	25.48179	20.26184	At most 1 *
0.466595	6.284737	9.164546	At most 2

Note: * indicates rejection of the null hypothesis at 5% significant levels.

Table 7 Results of Standardized Co-integration

1 Co-integration Equation(s):		Log likelihood	10.91420	
Normalized co-integration coefficients (standard error in parentheses)				
LNLWGDP	*LNLWEX*	*LNLWIM*	*C*	
1.000000	-3.124474	1.419061	-0.621275	
	(0.68611)	(0.61970)	(0.28426)	

Co-integration Equation:

$$LNLWGDP = 1.4191LNLWIM - 3.124474LNLWEX - 0.6213 \quad (3)$$

(0.6197) (0.6861) (0.2843)

From Equation 3, the coefficient of *LNLWIM* is 1.4191, which indicates that the imports have positive effect on economic growth of Laos. It shows that Lao imports from Yunnan increased by 1% will make GDP of Laos grow by 1.42%. While the coefficient of *LNLWEX* is -3.1245, which shows that the exports have a negative effect on the economy growth of Laos, i.e. Lao exports to Yunnan increased by 1% will make the Lao GDP decreased by 3.12%. And in terms of the absolute value of the coefficients, the exports' negative effect is greater than the imports' positive effect on economy of Laos. Lao imports from Yunnan can bring growth to the GDP of Laos and exports to Yunnan exists "export immiserating growth".

3.2.3. Granger Causality Test

Based on the above results, there is a long-term stable relationship among variables, but it does not mean that there is a causal relationship among them. Granger causality test is used to test the causality among variables. Granger causality test can test two-way causal relationship of multiple variables. According to the AIC and SC criteria, the lag order of each variable is determined as lag 1. The results of Granger causality test among variables are as Table 8 and Table 9.

(1) Yunnan Group

From Table 8, at the 10% level, there is a one-way causal relationship between Yunnan's GDP and Yunnan-Laos bilateral trade, i.e. Yunnan-Laos exports and imports are not the Granger cause for the GDP growth of Yunnan. But the GDP growth of Yunnan is the Granger cause of Yunnan-Laos exports and import. At the same time, there is a one-way Granger causality between imports and exports of Yunnan, i.e. Yunnan's exports to Laos is the Granger cause of Yunnan's imports from Laos.

Table 8 Results of Granger Causality Test

Null Hypothesis	F-Statistic	Prob.	Conclusion
LNYNEX does not Granger Cause *LNYNGDP*	2.65161	0.1475	Accept
LNYNGDP does not Granger Cause *LNYNEX*	5.58538	0.0501	Reject
LNYNIM does not Granger Cause *LNYNGDP*	0.29508	0.6038	Accept
LNYNGDP does not Granger Cause *LNYNIM*	17.6956	0.0040	Reject
LNYNIM does not Granger Cause *LNYNEX*	1.73760	0.2289	Accept
LNYNEX does not Granger Cause *LNYNIM*	3.84220	0.0908	Reject

(2) Laos Group

From Table 9, at the 10% level, there is a one-way causal relationship between Lao GDP and Laos-Yunnan bilateral trade, i.e. Laos-Yunnan exports and imports are not the Granger cause for the GDP growth of Laos. But the GDP growth of Laos is the Granger cause of Laos-Yunnan exports and import. At the same time, there is a one-way Granger causality between imports and exports of Laos, i.e. Lao imports from Yunnan is the Granger cause of Lao exports to Yunnan.

Table 9 Results of Granger Causality Test

Null Hypothesis	F-Statistic	Prob.	Conclusion
LNLWEX does not Granger Cause *LNLWGDP*	0.19428	0.6727	Accept
LNLWGDP does not Granger Cause *LNLWEX*	4.01940	0.0850	Reject
LNIWIM does not Granger Cause *LNLWGDP*	1.30887	0.2902	Accept
LNLWGDP does not Granger Cause *LNIWIM*	3.74891	0.0941	Reject
LNIWIM does not Granger Cause *LNLWEX*	3.84220	0.0908	Reject
LNLWEX does not Granger Cause *LNIWIM*	1.73760	0.2289	Accept

4. Conclusion

Economic theory holds that there is a certain relationship between foreign trade and economic growth. From the statistical analysis, Yunnan-Laos bilateral trade is reciprocal and promotes both economic growths. The results of ADF test, Johansen co-integration test and Granger causality test prove that the GDP and Yunnan-Laos bilateral trade have a positive equilibrium relationship in the long run. The regression results also show that Yunnan's exports to Laos promote both economic growths which in turn expand bilateral trade further. It’s expected that under the "One Belt, One Road" strategy, Yunnan-Laos bilateral trade will expand significantly.

To Yunnan, it should take the geographical advantages of bordering on Southeast Asian countries and expand the demand of foreign markets. Yunnan should continue to implement the strategy of “Going out”, seize the opportunity to strengthen the construction of the free trade area and promote the economic development. To enhance trade development, Yunnan could upgrade the export-oriented economy to achieve multi-type, multi-form of trade model and increase products or services differentiation to meet Lao demands.

To Laos, it can utilize import goods or services especially advanced technology which could improve the production efficiency and maximize the benefits to upgrade its industrial structure and focus on building a good trading environment to change the status quo of “export immiserating growth”.

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