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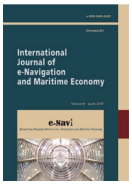

Original article

Research on Macroeconomics Factors Influencing Seaborne Trade in Vietnam: An Autoregressive Distributed Lag Approach ☆

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Abstract

It would appear that the diversification of the methods of international transport has made global trade much easier. With the outstanding advantages of cargo volumes, shipping costs and safety of goods, sea transport always accounts for a high proportion of the export and import activities of coastal countries. Today, therefore, seaborne trade is the main method of foreign trade in Vietnam and the world. Towards solutions in the area of seaborne trade development, this study aims to find the essential macroeconomics factors influencing directly seaborne trade by applying autoregressive distributed lag (ARDL) models with a case study of Vietnam. This paper finds that Vietnam's GDP and FDI have positive impacts on Vietnam's seaborne trade turnover in both the short run and long run. The findings here make a significant contribution to the search for practical scientific solutions to enhance Vietnam's seaborne trade development.

Keywords: Seaborne trade, ARDL model, GDP, FDI, Vietnam.

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1. Introduction

To achieve today's socio-economic achievements, the great contributions of foreign trade could not be denied, especially in the current period of time, global commercialization is the inevitable and irreversible trend in the world. The United Nations Conference on Trade and Development (UNCTAD) estimates that roughly 80 percent of global trade by volume and 70 percent by value is transported by sea. The above figure also indicates the importance of seaborne trade to the development of the world economy, especially with Vietnam - a country with a coastline of 3260km (Ministry of Culture, Sports and Tourism of Vietnam), ranked 32nd out of 156 countries bordering the sea. Therefore, it can be said that research about seaborne trade development is an important issue today. In consequence, the term *seaborne trade* is quite popular, which appears in broad ranges of specialized documents in the world. There have been also many studies focusing on different issues on seaborne trade such as seaborne goods (HWWI, 2006; Martin Stopford, 2009; UNCTAD, 2018), the shipping fleet, ports and related activities. However, in Vietnam, while foreign trade in general or import/export are mentioned a lot, there has been little, even no prior research on foreign trade by mode of transport, including seaborne trade.

With the ultimate aim of proposing solutions for seaborne trade development in Vietnam, in this context, the purpose of this study is to ensure the integration both theory and practice of solutions. Thus, this study aims to find out what macroeconomics factors have impact on seaborne trade and how they work.

Currently, the interaction between factors would be examine by many reliable scientific methods in terms of both quantitative and qualitative. In this paper, both of them will be applied to solve the research question. While methods of statistical analysis has been used for qualitative analysis, the estimation method by using ARDL (Autoregressive distributed lag) has applied to test the cointegration between the variables. The results present that the two macroeconomic variables, GDP and FDI, have positive and significant effects on the seaborne trade turnover in both the short-run and the long-run period.

With these reliable results, this work will enable the foreign trade and sea mode of transport managers to make effective and accurate planning decisions.

2. Data description and methodology

2.1. Data description

The selection of variables plays a decisive role in the research process. First of all, the dependent variable is the one represents the seaborne trade, which could be the volume of goods or the turnover. It can be seen that turnover is the product of the volume of goods and the market price. Therefore, the seaborne trade turnover that reflects both the volume and the price of goods is chosen in this context.

Regarding the variables representing macroeconomics, one of the most important economic variables of the national economy, known as “the size” of the economy, is gross national product (GDP). GDP is a measure of the gross domestic product and gross domestic income of a country. Furthermore, according to Vietnam maritime administration, GDP is the basis for forecasting the demand for sea transport by stages, the quantity of goods undertaken by Vietnamese shipping fleet, even more the fleet demand and its capital development by ship types to 2020 (Vietnam Maritime Administration, 2013, 2014). Therefore, GDP is selected to represent to the marcro economic variables on this study.

Second, according to General Statistics Office of Vietnam in 2019, the FDI sector contributed over 50% of the industrial output value, 72% of the export value, and 23,4% of Vietnam's social investment. Furthermore, FDI also creates positive externalities that increase the productivity of the economy through technology transfer as well as management skills and production, business experiences. Following the annual report on the results of implementation of the socio-economic development plan of Ministry of Planning and Investment the FDI sector is recognized as an integral part of the economy with its contribution to GDP, reaching 18.7% in 2008 to approximately 20% in 2019. FDI enterprises also contribute about 70% of the country's export turnover, of which more than half are 'high-value' *FDI*, such as advanced technology and manufacturing. Although FDI enterprises contribute a lot to Vietnam's high export growth, they are also large importers. According to an average estimate, for every 1 USD exported by FDI enterprises in Vietnam, about 0,4 USD is used to buy

foreign inputs. Thus, FDI enterprises occupy an important position in the foreign trade as well as the foreign trade of Vietnam sea, because 60-70% of the value of foreign trade goods is transported by sea (UNCTAD, 2018).

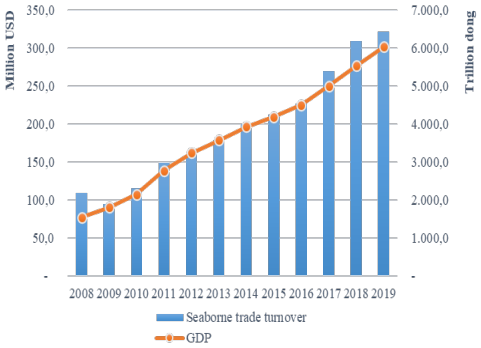
Finally, this paper selects the dependent variable representing the seaborne trade (seaborne trade turnover) and the two independent variables representing macroeconomic variables, including GDP and FDI.

This study employs quarterly time-series data taking the 2008 – 2019 period into consideration (48 observations), it means the time when Vietnam officially became a full member of the World Trade Organization (*WTO*). The data were obtained from sources of the World Bank 's and General Department of Customs.

This paper analyses the relationship among seaborne trade turnover, GDP and FDI, case study in Vietnam by combining qualitative and quantitative approaches. First, it starts by assessing qualitatively the development trends between Vietnamese seaborne trade turnover and its GDP, FDI. Second, the ARDL approach is employed to investigate both the long-run and the short-run linkages between these variables.

2.2. Qualitative analysis

As can be seen, the figures show that, the Vietnam's seaborne trade turnover increased over the past ten years, the same trend as GDP. Along with world economic growth, Vietnam's seaborne trade turnover rose by more than three times, from 109.4 million USD in 2008 to 321.8 million USD in 2019.



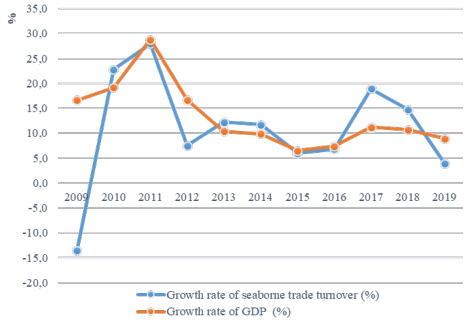


Figure 1: Fluctuations in size and growth rates of seaborne trade turnover and GDP

Source: the World Bank and General Department of Customs

At the same period, GDP went up by nearly four times, from 1552.6 trillion dong from the beginning to 6033.6 trillion dong till the end. The continuous growth rates of these two indicators over the years has been uneven due to the impact of many different economic factors in Vietnam and in the world. However, it can be seen from the graph, they had the same trends.

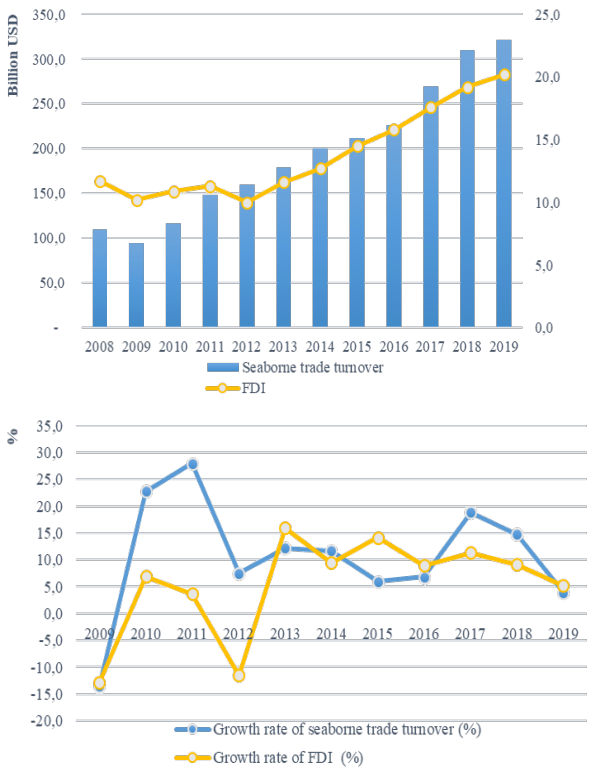


Figure 2: Fluctuations in size and growth rates of seaborne trade turnover and FDI

Source: General Statistics Office and General Department of Customs

The statistic represents the Vietnam's seaborne trade turnover and FDI had a consensus increase over the past ten years. FDI rose by 1.7 times, from 11.7 billion USD in 2008 to 20.2 billion USD in 2019. Regarding the growth rate, the average growth rate of FDI was lower than seaborne trade turnover's and they were both unstable during the research period.

2.3. Quantitative analysis - ARDL method

The statistical analysis above suggest a positive relationships between the Vietnamese seaborne trade turnover and its GDP, FDI. To confirm this relationship more clearly, the quantitative research method is a highly reliable option. In this study, the Autoregressive Distributed Lag (ARDL) approach, originally introduced by Pesaran and Pesaran 1997, developed by Pesaran and others (Pesaran and Shin 1999; Pesaran et al 2001), is used to determine cointegration between variables in model. There are reasons behind using this technique. First of all, the ARDL approach is useful in solving time series problems with taking sufficient number of lags to capture the data (Shrestha & Bhatta, 2018). In other words, the fact that the ARDL method may tolerate different lags in different variables. Secondly, The ARDL method has advantages over other approaches (Engle and Granger, 1987; Johansen, 1988; Johansen and Juselius, 1990) in the stability of the variables because some of variables in this study are stationary at level, whereas others are non-stationary (Shrestha, M. B., & Bhatta, G. R., 2018). So, in this case, the ARDL model is a better choice than the other econometric methods. In addition, this approach allows to estimate simultaneously for both short-run and long-run parameters (Kyophilavong et al., 2013). Finally, this paper employs the ARDL approach due to its statistical procedures in small sample sizes compared to VAR and VEC models (J.Duasa, 2010). Thus, it can be said that ARDL is a useful and flexible tool in multivariate time series analysis (Halil, 2000).

General form of ARDL model:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{n} \beta.\Delta Y_{t-i} + \sum_{k=0}^{n} \gamma.\Delta X_{1,t-k} + \ldots + \sum_{p=0}^{n} \phi.\Delta X_{m,t-p} + \sum_{m=1}^{n} X_m + \varepsilon_t$$

where:

i : the lag length of dependent variable

k,p : the lag length of independent variables

m : number of independent variables

β, γ : regression coefficients

ε_t : Random errors

$\Delta X, \Delta Y$: stationary variables

The form of ARDL model for this study to find out the short-run and the long-run relationship among variables as follow:

$$\Delta LKN_t = \alpha_0 + \sum_{i=1}^{n} \beta.\Delta LTURNOVER_{t-i} \sum_{i=1}^{n} \gamma.\Delta LGDP_{t-i} + \sum_{i=1}^{n} \phi.\Delta LFDI_{t-i} + \beta_1 LTURNOVER_{t-1} + \beta_2 LGDP_{t-1} + \beta_3 LFDI_{t-1} + \varepsilon_t$$

where:

$\Delta L(\,)$: stationary variables

L() : logarit variables

$\beta, \gamma, \phi, \beta_i$: regression coefficients

Table 1: Summary statistics

Variables	Minimum	Maximum	Mean	Std. Dv
Turnover	2.33E+10	8.07E+10	4.89E+10	1.84E+10
GDP	368970.1	1551983.	923862.2	351869.8
FDI	2456.278	5199.320	3450.737	872.1741

3. Estimates, Results and Analysis

3.1. Stationary tests

A stationary time series is a is a necessary category for the estimation process in economics. A time series is called stationary when the mean, the variance, the covariance is constant over all times (Gurajati, 2003). The stationary distribution tends to return to averages and the fluctuations around the mean will be the same. Conversely, a series that has not reached the stationary state will have a time-varying means or variances. It means the estimated result is only applicable for one period. Therefore, it is necessary to determine the stationary state of all variables in the regression model. In fact, most of the time series are non-stationary (Ramanathan, 2002). However, it is possible to convert them to a stable chain through a differential process. In this study, Unit Root Test, based on the extended Augmented Dickey Fuller (ADF) (Nguyen Quang Dong, Nguyen Thi Minh, 2013) test is used to check stationarity of each variable.

The results showed that all variables stationary at the first difference.

Table 2: Unit Root Test

	ADF-stats	p-value	results
LFDI	0.9805	0.9957	non-stationary
LGDP	-2.3874	0.1508	non-stationary
LTURNOVER	-1.5922	0.4784	non-stationary
First Difference			

LFDI	-5.9751	0.0000	stationary at 5%
LGDP	-3.3393	0.0749	stationary at 10%
LTURNOVER	-3.5751	0.0102	stationary at 5%

3.2. Johansen test

The Johansen estimation method proposes two tests: Trace test and the maximum eigenvalue test based on estimation of the correct number of cointegration relations. The goal of this approach is to show how many linear combinations of these variables are stationary for a number of non-stationary variables. Economically, this means determining how many cointegration relationships exist over the long run.

Table 3: Johansen cointegration test

Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
	0.419720	45.74397	35.01090	0.0025
At most 1 *	0.225423	20.70875	18.39771	0.0234
At most 2 *	0.176962	8.958618	3.841466	0.0028

With significance levels are less than 0.05, the above results show that, there exist three long-term relationships between the variables in the model. Once a long-term relationship is identified in the model, the short-term relationship will continue to be tested.

3.3. Optimal lag length selection

Optimal lag length is the lag at which the variables are modeled over the hysteresis variable and other variables with the same lag length give the best results.

In time series analysis, determining the optimal lag length is of paramount importance. The Johansen co-integration test requires suitable lag. If the lag length is too short, the remainder estimation does not satisfy the white noise, which make *false*-significant *results.* In the ARDL model, the optimal lag length is determined based on the standards AIC (Akaike Information Criterion), SC (Schwart Bayesian Information Criterion) and HQ (Hannan - Quinn Information Criterion). According to these standards, the optimal lag length selected is the lag with the smallest index.

Table 4: Optimal lag length selection

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	321.8001	NA	7.29e-11	-14.82791	-14.70504	-14.78260
1	354.2531	58.86809	2.45e-11*	-15.91875*	-15.42725*	-15.73750*
2	360.1436	9.863226	2.86e-11	-15.77412	-14.91400	-15.45694
3	362.3849	3.440046	3.98e-11	-15.45976	-14.23102	-15.00664
4	378.9548	23.12087*	2.89e-11	-15.81185	-14.21448	-15.22279

The results show that the optimal lag selection is 1. The lag length 1 will be included in the ARDL regression analysis.

3.4. The final ARDL estimation results

When the long-term cointegration relationships between variables are confirmed, the long-run regression coefficients and the short-term relationships between the variables in the model will be estimated according to the autoregressive distributed lag equation (ARDL).

Table 5: Results of coefficient estimates

Dependent variable: TURNOVER

Short Run Coefficients

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LGDP)	1.569528	0.197114	7.962553	0.0000
D(LFDI)	0.297550	0.068327	4.354763	0.0001
CointEq(-1)	-0.245851	0.045188	-5.440602	0.0000

Cointeq = LTURNOVER-(0.9868*LGDP + 0.1810*LFDI + 9.4752)

Long Run Coefficients

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LGDP	0.986795	0.074303	13.280742	0.0000
LFDI	0.180992	0.089475	2.022828	0.0496
C	9.475194	0.565271	16.762200	0.0000

From the table above, the results of the ARDL equation are obtained as follows:

$LTURNOVER_t = 9.475194 + 1.569528 * D(LGDP_t) + 0.297550 * D(LFDI_t) + 0.986795 * LGDP_t + 0.180992 * LFDI_t$

As can be seen from the relationship coefficients table, in the short run, GDP and FDI both have a positive impact on the seaborne trade turnover with a lag of 0. It means, an increase of 1% in the GDP and FDI increase immediately the seaborne trade turnover amount by

1.56% and 0.29% in the same quarter, respectively. In the long run, GDP and FDI both have a positive impact on the seaborne trade turnover with coefficient (βi) 0.986795 and 0.180992, respectively. It means when 1% increase in GDP, FDI can increase the seaborne trade turnover by 0.98%, 0.18%, respectively.

Table 6: Results of F-statistics for ARDL

	F-statistic	Probability
Breusch-Godfrey Serial Correlation LM Test	1.125642	0.2951
Heteroskedasticity Test	1.591105	0.2138
Ramsey RESET Test	1.398365	0.2440

After coefficient estimation and check the F-statistics, the results show that the model is suitable, no autocorrelation between variables and no variances phenomenon. This proves that the results of the model are completely reliable.

4. Conclusion and Recommendations

After making a study about the development trends between the macroeconomic variables and seaborne trade, a econometrics model is applied to quantitatively test the above relationship. Based on the theoretical and practical basis, the seaborne trade turnover variable represents seaborne trade; the macroeconomic variables are GDP and FDI. In the scope of the research, data collected after Vietnam officially joined the World Trade Organization (WTO), the period 2008 - 2019 quarterly, creating 48 observations.

By using the autoregression distributed lag (ARDL) model to test the cointegration relationship between the three variables of seaborne trade turnover (TURNOVER), GDP and FDI, applied on the quantitative analysis software eviews 9.0, this paper releases the following conclusions:

First, in the short run, GDP and FDI both have a positive impact on the seaborne trade turnover with a lag of 0. It means, an increase of 1% in the GDP and FDI increase immediately the seaborne trade turnover amount by 1.56% and 0.29% in the same quarter, respectively.

Second, in the long run, GDP and FDI both have a positive impact on the seaborne trade turnover with coefficient (βi) 0.986795 and 0.180992, respectively. It means when 1% increase in GDP, FDI can increase the seaborne trade turnover by 0.98%, 0.18%, respectively.

Third, the above model also satisfies the F-statistics tests, it means the model is suitable, no autocorrelation between variables and no variances phenomenon.

In conclusion, it can be affirmed that the econometric model used is completely appropriate and valid in pointing out the impact of important macroeconomic variables on Vietnam's seaborne trade. Accordingly, GDP and FDI positively and significantly affect Vietnam's seaborne trade in both the short-run and the long run. This result is the scientific and practical basis to propose solutions for the development of Vietnam's seaborne trade in the next studies.

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