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Article · May 2014

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# Greener Journal of Business and Management Studies

ISSN: 2276-7827

ICV (2012) 6.03

Submission Date: 22/04/014

Accepted: 12/06/014

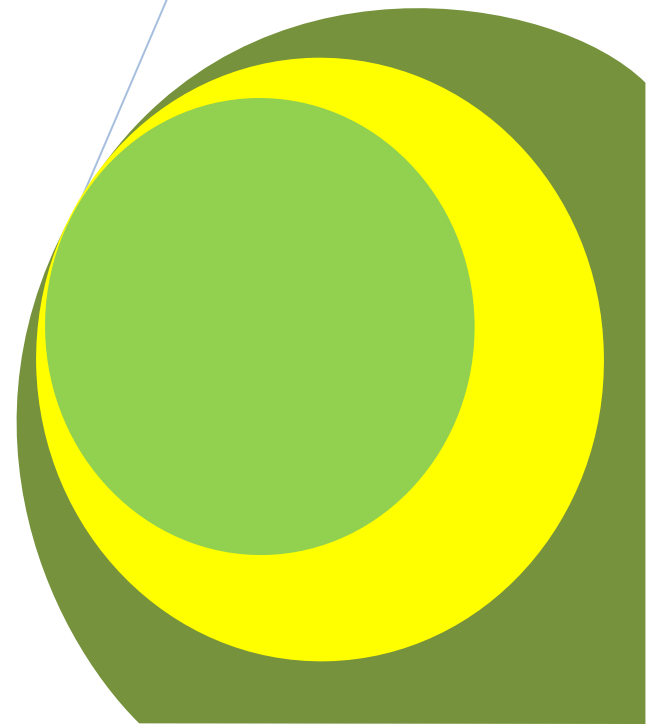
Published: 13/06/014

## **Influence of International Trade Flows on International Trade in Logistic Services in Macedonia**

By

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*Research Article*

# **Influence of International Trade Flows on International Trade in Logistic Services in Macedonia**

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## **ABSTRACT**

Analyzing relations between international trade of goods and international trade in logistic services has always been a challenge for researchers. Most of the studies point their focus on the impact of logistic services on international trade flows as these services are considered as an important factor for international competitiveness improvement of an economy. It must be kept in mind that there is a mutual interaction between international trade and logistic sector development. Volume and intensity of international trade of goods also has an impact on international trade in logistic services. Therefore, this paper aims to determine and to measure the effect that international trade of goods in Republic of Macedonia has on the international trade in logistic services. For that purpose, key indicators for international trade value and dynamics were calculated as well as the effects of an explanatory variable on the response variable were determined with correlation and regression analysis of selected data.

**Keywords:** International trade flow, Logistic services, Macedonia, regression.

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## **INTRODUCTION**

International trade and economic growth are related to each other. In most countries, international trade represents a significant share of gross domestic product (GDP). Industrialization, advanced transportation, globalization, multinational corporations, outsourcing and other factors are all having a major impact on the international trade. Complex international economic relations create more compound relations between all subjects involved in international trade. As for illustration, some researches indicate that there are potentially 27-30 different parties involved in normal trade transaction, including brokers, banks, carriers, sureties and freight forwarders, handling approximately 40 documents, 200 data elements of which 60-70 per cent are rekeying at least once (SWERPO, 2002). Other researches point out that 95% of international trade is outsourced on specialized logistic providers and that 70%-80% of total container flow is controlled and organized by logistic operators (Trajkov, 2012). All these data support the statement of importance of trade logistics as one of the crucial activities that are initiating and supporting trade facilitation.

Generally, trade logistics which encompasses an array of actions, from transportation, consolidation of cargo, warehousing, and border clearance to in-country distribution and payment systems (Jean-François et al., 2012), globally was valued 3.5 billion USD in 2005 (ICRIER, 2008). Additionally, logistic expenditures represent 10-15% of the total world GDP (ICRIER, 2008). The importance of logistics and transportation costs for international trade flows is analyzed in many research papers (Francois and Hoekman, 2010; Hummels, 2007; Hummels and Lugovsky, 2006; Clark et al., 2004; Anderson and van Wincoop, 2004). The factors that determine trade flows are also analyzed by Helpman et al. (2008). Still, considering the characteristics of trade logistics, the fact that the volume of international trade of goods has an impact on the volume of trade in logistic services cannot be ignored.

The main research objective of this paper is to determine and to measure the impact of international trade of goods in Macedonia (explanatory variable) on the value of international trade in logistic services in the country (response variable). In that order, Pearson coefficient of correlation - R, Coefficient of determination or R square and Adjusted R square should be calculated by using statistical methods of correlation and regression analysis. The type of regression and regression coefficients will be determined in order to measure the influence of international trade of goods on trade in logistic services.

For the purpose of the study, the value and dynamics of international trade of goods and international trade in logistic services will be determined by calculating base and chain indexes which will make the process of comparing the changes of the variables easier.

These statistical methods and calculations will help in providing solid scientific results for the final remarks and conclusions. All the data for the research will be taken from official statistical reports of the Central Bank of the Republic of Macedonia, the Statistical Office of Macedonia, the International Monetary Fund and the World Bank.

### INTERNATIONAL TRADE FLOWS IN REPUBLIC OF MACEDONIA

Beginning from claiming its independence in 1991, the Republic of Macedonia has a constant growth of international trade of goods until 2008. Small declines in 1999 and 2001 are due to the political instability of the region and the country in that period. This period is characterized with constant rise of the trade balance deficit (see Fig. 1).

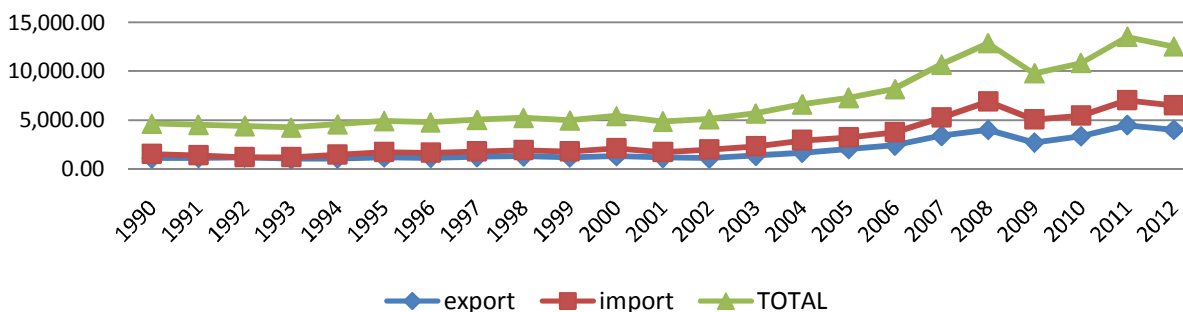


Figure 1: International Trade In Goods In Republic Of Macedonia (,000 USD)

Source: Own presentation of the data taken from Central Bank of Republic of Macedonia, *Key economic indicators of Republic of Macedonia*, internet edition: <http://www.nbrm.mk/?ItemID=750FC531FC3D1B49B16440313562D400>, 21.01.2014

Another characteristic of international trade flows in Macedonia is the huge gap between the volume of trade in 2008 and 2009 when the export had declined for about 28% and the import had declined for 23%. It resulted with 24% decline of total trade in 2009 compared to 2008 (Ministry of economy of RM, 2011). These changes were due to the world economic crises that had a strong impact on overall economic performance in Macedonia, including international trade. Macedonian economy is vulnerable on world economic influences as it has high degree of trade openness. This statement can be confirmed with simple calculation of international trade coefficient (ITC) as a ratio of total international trade and GDP of the country (WTO, 2012). For small and open economies like Macedonia, ITC is substantially above one (see table 1).

TABLE 1: Degrees of Openness of the Republic of Macedonia

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
ITC	1.20	1.22	1.25	1.31	1.31	1.05	1.16	1.29	1.30

Source: own calculation (GDP data are taken from [www.data.worldbank.org](http://www.data.worldbank.org) on 12.01.2014)

After the crises, there was a period of stabilization resulting with 10.7 and 24.7% growth in 2010 over 2009 and 2011 over 2010 respectively. Total international trade has reached its peak in 2011 before the next decline of 7.3% in 2012 (table 2).

Analysis of international trade in logistic services is more complex than analysis of international trade of goods. Main reason for that is lack of raw and arranged data for trade logistic sector. Logistic services are not categorized as a specific service sector in the United Nations Central Product Classification. Also, these services are not defined as a separate category of services under the General Agreement on Trade in Services (GATS) Classification list W/120. Overview of international trade in logistic services in this study is based on the trade activities suggested in the Checklist of logistic services TN/S/W/20 under the GATS. Some methodological issues that have to be considered when collecting data for international trade in logistic services are explained by Trajkov and Biljan (2012, 2012a).

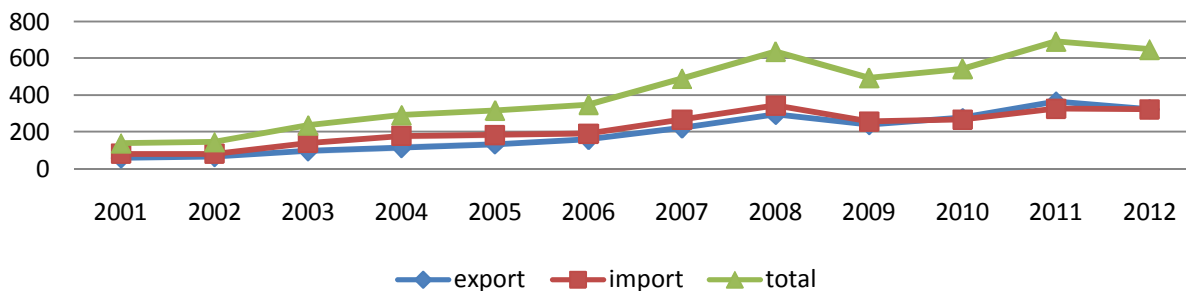


Figure 2: International trade in logistic services in Macedonia (,000 USD)

Source: own presentation of the data taken from IMF, *BalanceofPaymentsStatisticsOnline*: <http://elibrary-data.imf.org/DataExplorer.aspx>, 30.01.2014

Total value of international trade in logistic services in Republic of Macedonia had a constant growth in the period 2001 – 2008 with average annual growth rate (AAGR) of import and export of 40.3% and 50.1%, respectively (Trajkov and Biljan, 2012).

Following the general economic trends, there was 18.8% decline of the export of logistic services in 2009 compared to the previous year. It was a result of the global economic crisis that caused reduced economic activity in general. Decline of import of logistic services in 2009 compared to 2008 was even greater, amounting to 25.5% (Trajkov, 2012). In line with the general trends of the total trade in goods was the growth of trade in logistic services in 2010, where the value of exports in this period exceeded the value of imports of logistics services. For the first time in the last decade, a positive trade balance in logistics services was marked. Positive trend of international trade in logistic services sustained in 2011 with a small decline of 6.2% in 2012 compared to 2011 (See table 2).

TABLE 2: Total International Trade in Selected Categories in Republic of Macedonia, (Millions Usd) and Trade Flow Changes

Year (Y)	International trade in logistic services	Total international trade of goods	Logistic services trade (AGR %) <sup>1)</sup>	Trade of goods (AGR %) <sup>1)</sup>	Logistic services trade (2001=100) <sup>1)</sup>	Trade of goods (2001=100) <sup>1)</sup>
2001	139.89	4852.11			100	100
2002	145.556	5112.69	4.1	5.4	104.1	105.4
2003	235.87	5676.34	62.0	11.0	168.6	117.0
2004	292.185	6611.51	23.9	16.5	208.9	136.3
2005	317.142	7280.14	8.5	10.1	226.7	150.0
2006	349.253	8173.42	10.1	12.3	249.7	168.5
2007	488.447	10685.85	39.9	30.7	349.2	220.2
2008	636.586	12881.29	30.3	20.5	455.1	365.5
2009	493.93	9790.31	-22.4	-24.0	353.1	201.8
2010	543.206	10835.91	10.0	10.7	388.3	223.3
2011	690.39	13516.47	27.1	24.7	493.5	278.6
2012	647.32	12524.78	-6.2	-7.3	462.7	258.1

Source: IMF, Central Bank of Republic of Macedonia and <sup>1)</sup> own calculations  
 AGR - Annual Growth Rate =  $(Y_n/Y_{n-1}) * 100 - 100$

Calculations on the AGR has pointed out that international trade of goods and international trade in logistic services do change in the same direction in the analyzed period (table 2). The only difference between these variables is in the intensity of the change. Results are indicating that in a case of growth, there are more intensive changes of AGR on international trade in logistic services compared to AGR on international trade of goods in the country. In case of decline of the values of international trade of selected categories, there are more intensive changes of AGR on

international trade of goods compared to international trade in logistic services. The obtained results from calculated base indexes, with 2001 as a base year, showed that international trade in logistic services has increased for nearly 400% in a decade compared to 178% growth of international trade of goods (table 2). Now, it can be concluded that certain changes on international trade of goods in Macedonia are affecting more intensive changes on international trade in logistic services. The next step is to measure and calculate the strength of association between these numerical variables by using the statistical method of correlation and regression analysis.

### Regression Analysis

As it was mentioned before, these variables are numerical and the data used for regression analysis are taken from table 2, where international trade of goods is explanatory variable (X) and international trade in logistic services is response variable (Y).

In order to determine the right type of regression, individual values of the variables are plotted on two dimensional scatter diagram (Fig. 3). An examination of Fig. 3 indicates positive linear relationship between international trade in goods (X) and international trade in logistic services (Y). As X value increases, Y value increases as well.

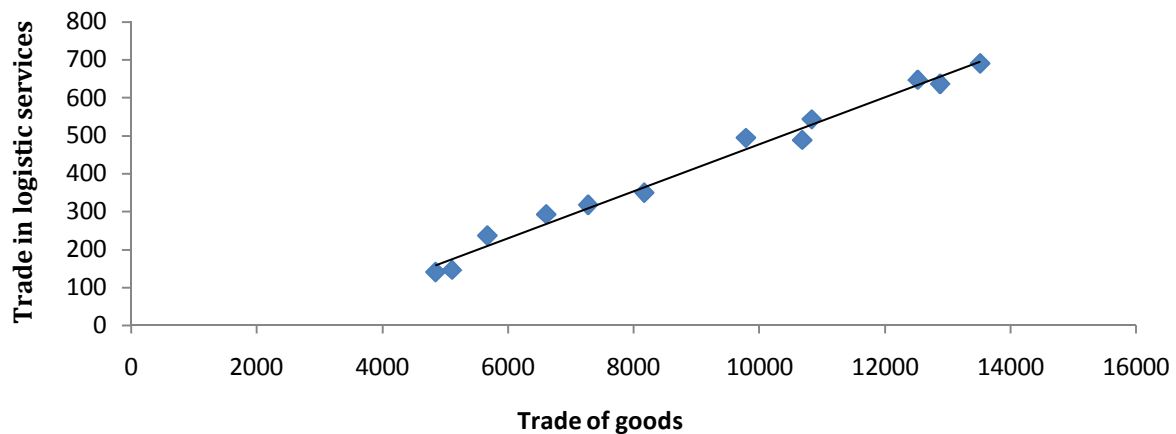


Figure 3: Impact of International Trade of Goods on International Trade in Logistic Services in Macedonia, in Millions Usd  
Source: own presentation of table 2 data

The linear regression analysis is concerned with finding the straight line that fits the data best. The used model can be represented as in equation 1.

$$\hat{Y}_i = \beta_0 + \beta_1 X_i + \epsilon_i \quad (1), \text{ where}$$

$\hat{Y}_i$  = predicted value of international trade in logistic services for observation i  
 $X_i$  = value of international trade of goods for observation i  
 $\beta_0$  = Y intercept for the population  
 $\beta_1$  = slope for the population  
 $\epsilon_i$  = random error in Y for observation i

Mathematical technique that determines the values of the Y intercept and the slope that best fit the observed data is known as the least squared method. Using this method, two equations to determine these values were obtained (eq. 2 and eq. 3):

$$\beta_0 = \frac{\sum y}{n} - \frac{b \sum x}{n} \quad (2)$$

$$\beta_1 = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2} \quad (3)$$

Therefore,  $\beta_1 = 0.0618$  and  $\beta_0 = -141.3177851$ . Thus, the equation for the best straight line for these data is:  $\hat{Y}_i = 0.0618X_i - 141.3177851$ .

Calculated value of the slope means that for each increase on one unit in X, the value of Y is estimated to increase by an average of 0.0618 units. That is, for each increase of 1 million USD of the value of international trade of goods, the fitted model predicts that expected value of international trade in logistic services is estimated to increase by 61800 USD. The Y intercept represents the average value of Y when X = 0. Since the value of international trade of goods is unlikely to be zero, this Y intercept can be viewed as expressing the portion of the international trade in logistic services that varies with factors other than international trade flows. The regression model that has been fit to the data can also be used to predict the international trade in logistic services for a certain value of international trade flows.

Measuring the degree of association between these variables can be done by using the correlation analysis and calculating the Pearson coefficient of correlation – “r” (see equation 4).

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2} * \sqrt{n \sum y^2 - (\sum y)^2}} \quad (4), \text{ where}$$

x, y – values of variables  
n – number of observations

Values of the Coefficient of correlation range from -1 for a perfect negative correlation up to +1 for a perfect positive correlation. In linear regression, r takes the sign of  $\beta_1$ . In that order positive value of the Pearson coefficient is expected, indicating strong and positive correlation.

In order to examine how well the explanatory variable predicts the response variable in the statistical model, the Coefficient of determination –  $r^2$  needs to be calculated. This coefficient measures the proportion of variation that is explained by the explanatory variable in the regression model. For more precise and reliable data, some researchers suggest calculating adjusted  $r^2$  obtained by adjusting the degrees of freedom (see equation 5).

$$r_{adj}^2 = 1 - [(1 - r^2) \frac{n - 1}{n - 2}] \quad (5)$$

Analyzing the scattered plot (fig. 3) it is easy to observe that not all data values fall exactly on the regression line. This line only serves as an approximate predictor of a Y value for a given value of X. Therefore, a statistic that measures the variability of the actual Y values, from the predicted Y values is needed. Measuring the variation around the fitted line of regression can be done by calculating the Standard error of the estimate (equation 6)

$$S_{yx} = \sqrt{\frac{\sum Y^2 - \beta_0 \sum Y - \beta_1 \sum XY}{n - 2}} \quad (6)$$

All regression statistics in this article were calculated individually and all results were confirmed and verified by using Data analysis package in MS Excel. The obtained results are given in table 3.

TABLE 3: Regression Output

Measure	Result
Multiple R	0.993468393
R Square	0.986979448
Adjusted R Square	0.985677393
Standard Error	23.2826915
Observations	12

Source: own calculations

Value of the Multiple R (Pearson coefficient) of 0.99 has confirmed the expectations for a strong and positive correlation between international trade flows in Macedonia and the international trade in logistic services. Coefficient of determination and adjusted R Square were calculated 0.987 and 0.986 respectively. Therefore, 98.7% of the variation of international trade in logistic services can be explained by the variability in the value of international trade of goods. This is an example of a strong linear relationship between these variables, since only 1.3% of the sample variability can be explained by factors other than the one in the model. Standard error of the estimate equal to 23.28 (23.3 million USD) represents a measure of the variation around the fitted line of regression. It can be used in making

inferences about a predicted value of Y and in determining whether a statistically significant relationship exists between the two variables.

**TESTING STATISTICAL SIGNIFICANCE OF THE MODEL**

The null and alternative hypotheses are needed to be establish to test the statistical significance of the model. It can be determined whether significant relationship between explanatory and response variable exists by testing whether  $\beta_1$  is equal to zero. If this hypothesis is rejected, one could conclude that there is evidence of linear relationship. Therefore, the following hypotheses were stated:

$$H_0: \beta_1=0$$

$$H_1: \beta_1\neq 0$$

Level of significance  $\alpha$  is set on 0.05. Testing the hypotheses can be done by using ANOVA to calculate F value and significance F or using t-test statistic to calculate “p” and “t” – values.

MS Excel software is used for all the calculations. Results of ANOVA are given in table 4. Results indicate that  $F > F_{\text{signif}}$  which confirms that the used model has statistical relevance. It means that probabilities that the regression output could have been obtained by chance are very small. Validity of regression output can also be confirmed by comparing p value result with  $\alpha$  level of confidence. As seen from table 5,  $p < \alpha$  which also approves the model results.

TABLE 4: Anova

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	410908.4521	410908.4521	758.0165834	9.26E-11
Residual	10	5420.837236	542.0837236		
Total	11	416329.2894			

Source: own calculations

Calculations for t-stat given in table 5 are made using MS Excel. Critical value of t is calculated using MS Excel formula for a two tailed t distribution having  $n-2 = 10$  degrees of freedom and  $\alpha=0.05$  level of confidence. Since  $t=27.53 > t_{10}=2.228$   $H_0$  was rejected. It can be concluded that there is significant linear relationship between international trade of goods and international trade in logistic services in Macedonia.

TABLE 5: Testing The Model With T- Statistics And Confidence Interval

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-141.3177851	21.29400513	-6.63650564	5.80645E-05	-188.764	-93.8718
X Variable 1	0.061844898	0.002246283	27.53210096	9.26013E-11	0.05684	0.06685

Source: own calculations

Another equivalent method for testing the existence of a linear relationship between these variables is to set up a confidence interval estimate of  $\beta_1$  and to determine whether the hypothesized value  $\beta_1=0$  is included in the interval. From the output in table 5 the true slope is estimated with 95% confidence to be between +0.05684 and +0.06685 (that is \$56840 and \$66850). Having these values above 0, it can be concluded that there is significant linear relationship between international trade of goods and international trade in logistic services. On the other hand, had the interval included zero, no relationship would have been determined.



## CONCLUSION

Trade logistics is one of the crucial activities that are initiating and supporting trade facilitation. It was highlighted that most of the research studies focus on the impact of logistic services on international trade flows as these services are considered as an important factor for international competitiveness improvement of the country. Still, bearing in mind the characteristics of logistic services it must be considered the mutual interaction between international trade and logistic sector development. Therefore, it can be concluded that volume and intensity of international trade of goods also has an impact on international trade in logistic services.

The results of this research showed that certain changes on international trade of goods in Macedonia are affecting more intensive changes on international trade in logistic services. Also, expectations for a strong and positive correlation between international trade flows in Macedonia and the international trade in logistic services were scientifically confirmed. Calculations have shown strong linear relationship between these variables, since only negligible percent of the sample variability can be explained by factors other than the one in the model. It leads to a general conclusion that international trade in logistic services is highly dependable on international trade of goods and consequently it is becoming significant factor that also determines overall trade flows.

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**Cite this Article:** Aleksandar T, Jovanka B, 2014. Influence of International Trade Flows on International Trade in Logistic Services in Macedonia. *Greener Journal of Business and Management Studies*, 4 (2): 45-51.