Cointegration Analysis of Exports, Imports and Real GDP: Case of North Macedonia

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Abstract

Exports and imports of a given country are a part of its Gross Domestic Product and these economic notions are a very important indicator when we evaluate the economic growth and do economic forecast of a particular country. From a lot of growth theories, it is very hard to choose one theory in order to present the whole economic situation of a given country. North Macedonia, a country with a lot of socio-economic problems, some of them inherited from the pre-transition era, has had economic growth based on consumption growth and growth of imports. The cointegration analysis between exports, imports and the real GDP of North Macedonia is done to see the long-term relationship among the pre mentioned variables. To see the short-term response of the equilibrium of these series, the VECM model is presented and other relevant tests are done to see the validity of the model. In the case of North Macedonia there is no long-term equilibrium between the variables so we have presented the VAR model instead.

Keywords: cointegration, real GDP, economic growth, VECM, VAR, North Macedonia

Introduction

North Macedonia has faced a lot of social, economic and political challenges, almost 30 years after the beginning of transition it's still facing high rate of unemployment, low GDP growth rate and GINI coefficient falling.

According to the data of National Bank of North Macedonia the average exports value of North Macedonia starting from 1998 until 2017 are 34335.81 million denars, where the highest value was in October 2018 and the lowest value in January 2003 with 15417.22 million denars. Average imports value of North Macedonia from 1994 until 2017 is 49058.22 million of denars with highest value in October 2018 and the lowest value in February 2003 with 17371 million denars. The average value of real GDP is 85845.39 million denars, period 1998-2017.

When countries are capable of fulfilling international trade liabilities, we can say that those countries have long-term equilibrium of exports and imports. When a country has a great gap between these two components of GDP then it is very difficult to meet the constraints and international trade goals. Husted (1992) with quarterly time series data proved his hypothesis that series of exports and imports of USA are cointegrated series, adding that the series started to diverge slightly one from another starting from 1983. There is also empirical evidence that exports and imports do cointegrate in the paper of Arize (2002), where is shown that out of 50 countries taken for analysis 35 of them showed such long-term relationship although some of those relationships were unstable. Amiri (2011) also proved that there is a long term

cointegration between economic growth, exports and imports. Similar results were obtained by Rahman (2011). Following Husted, Ali (2013) was analysing the relationship among exports and imports of Pakistan and he proved that, as he states, "Pakistan economy is in obedience of international budget constraint". From the African countries we have the case of Nigeria analyzed by Babatunde (2014), there is also the case of showing us that the exports and imports do cointegrate. On the other hand, Vogiatzoglou et al., (2016) analyzed beside of the exports and imports also and the economic growth for five Asian countries. The authors further developed a VECM model and added that the GDP and FDI have two ways causality.

Data, methodology and empirical analysis

Data and description of variables

We use two sets of data in this paper. The first set is quarterly data from the period 1998-2017 and the source is from National Bank of North Macedonia and the second set is annual data for the period 2006-2018 and their source is from the Stat Statistical Office. The first set is used to analyze the cointegration relationship among the variables and the VAR model is constructed with those data. With the second set of data are done the graphs of the exports and imports with their corresponding categories.

The real GDP series (variable) is taken into consideration to see the dependency of the economic development and trade deficit. It should be noticed that the values of the real GDP are not put on the cointegration test, but rather the values of the logarithm of real GDP which is closely to the rate of economic growth. The series of exports and imports are taken in their level, because as we know cointegration's first condition is series to be at their level and non-stationary.
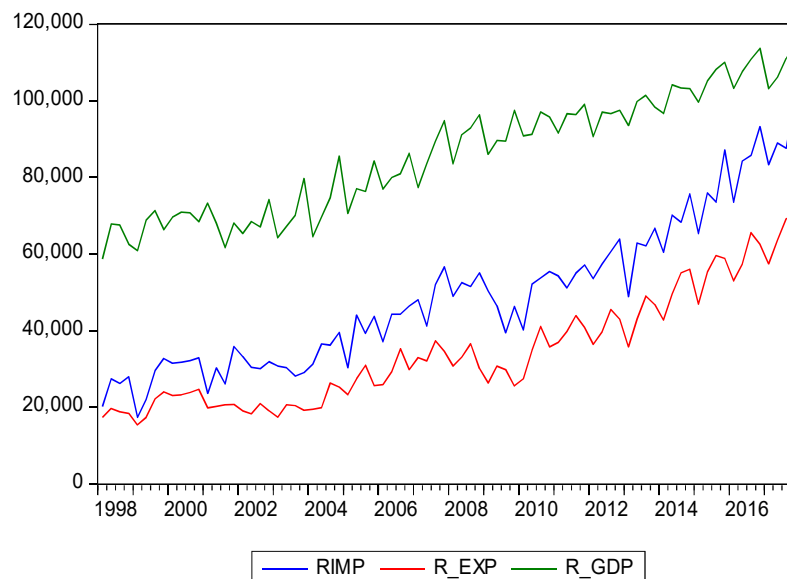

Figure 2.1.1 Exports, Imports, Adjusted Exports and Adjusted Imports of North Macedonia, quarterly data, 1998-2018, in millions of denars
Source: National Bank of North Macedonia

In the *Figure 2.1.1* we can notice that there is a substantial gap between the exports and imports of North Macedonia. The series seem to diverge more since 2001.

Macedonia as a country of import led growth has faced a lot of challenges and structural changes during the post transitional period. In the graph bellow we can observe that there is a significant gap between exports and imports of North Macedonia. Maybe that is the case why there is not a long-term relationship between the variables of exports and imports. Exports as we can see are substantially lower than the imports and that is why this country has always a negative paying balance on its international account. For further reference the reader should know that for modeling are taken variables of exports and imports that are seasonally adjusted by the additive method. This step is usually taken when we have seasonal data such in this case where we have quarterly time series. In the graph also we can notice that the adjusted series vary just a bit from the real ones. Other thing that is noticeable is the trend of the series. The trend is quite visible and growing of course. Before the 2000 the series seem to have been closer to one another, but the gap over the years has become larger.

Analyzing the graph for the categories of exports we can see that North Macedonia mainly exports are iron and steel, clothes and something that is very noticeable is that electric machines and parts have started to grow since 2013. The concerning is the fact that the export of iron and steel category has changed and shows decreasing trend to some point in 2016, from which started to increase slightly. Anyhow the exports of iron and steel are much lower than 2007 and 2008 when it showed some promising values reaching up to 900 million euros. Clothes are stable series with no trend whatsoever.
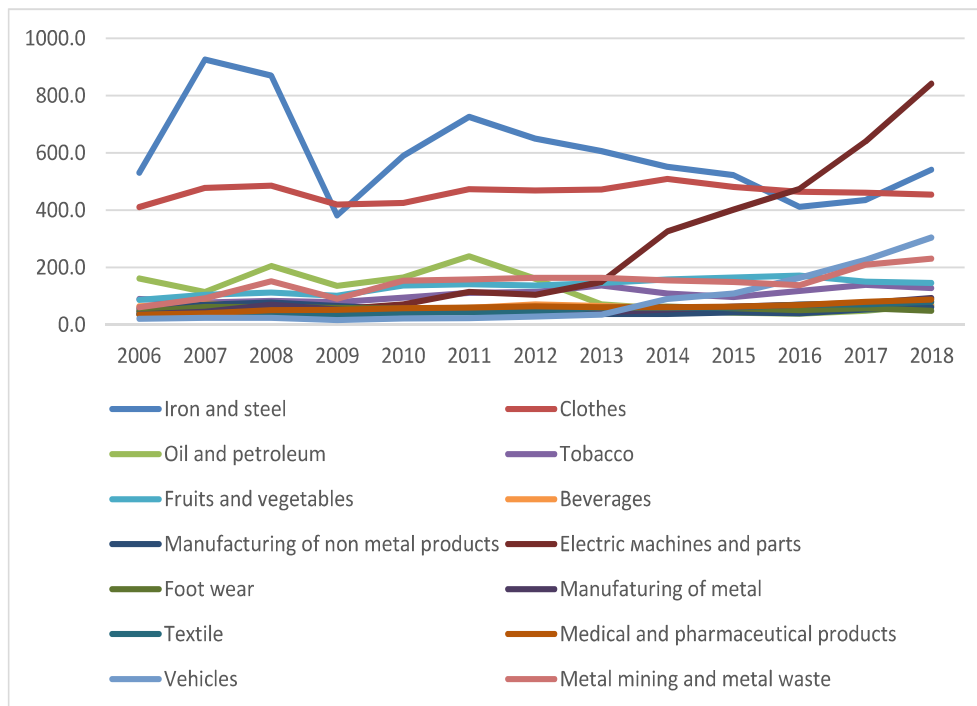

Figure 2.1.2 Exports for chosen category of goods of North Macedonia, annual data, 2006-2018 in millions of Euros
Source: State Statistical Office of North Macedonia

Observing the categories of imports, we can notice that category of *oil and oil products* has decreased through the years. Being the most imported category for several years it has been out passed by the category of *electric machines and parts*. The category of *Textile* somehow has a steady trend. *Steel and Iron* is a category that has changed through the time, even though it is not as high as in 2008 the level is on the rise. Worth of mentioning is the category of *Processing of nonmetal materials* that is been having a stable linear trend increase starting from 2013.
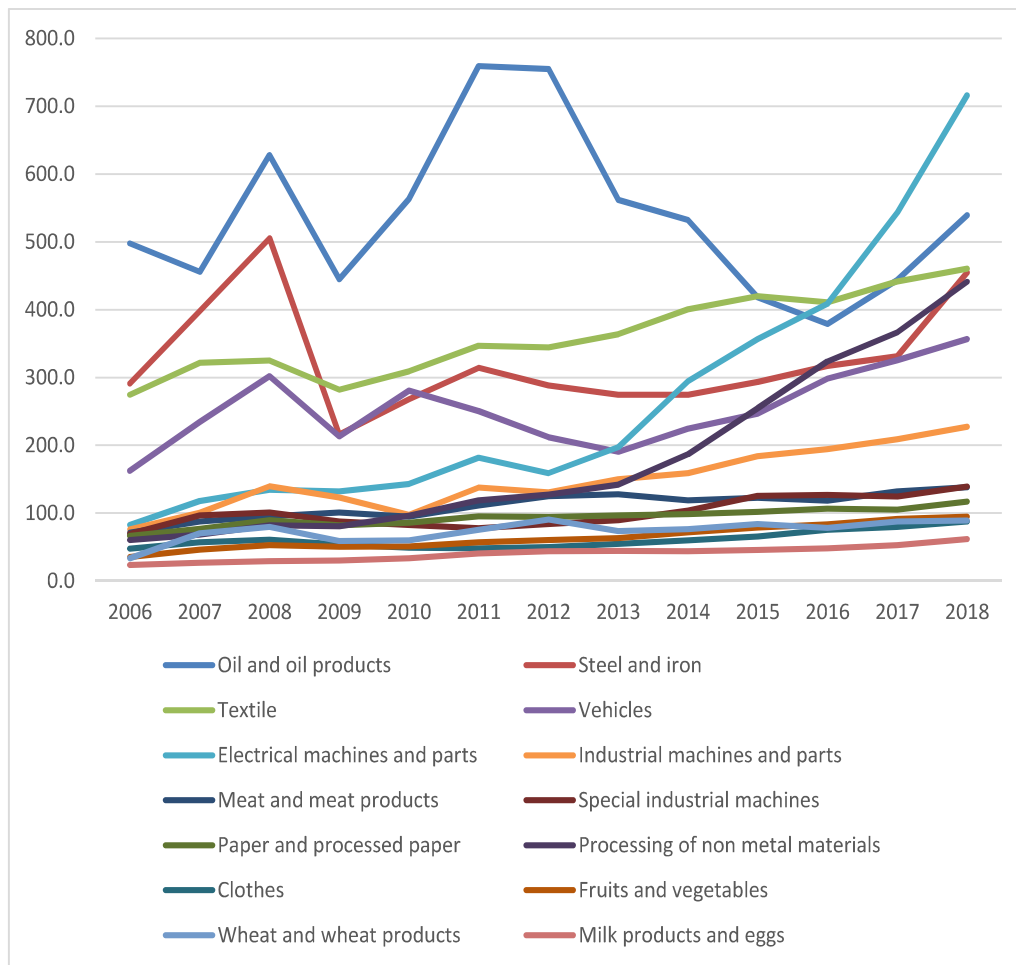

Figure 2.3 Imports of chosen goods of North Macedonia, annual data, 1996-2018 in millions of Euros
Source: State Statistical Office of North Macedonia

Empirical analysis

There are many empirical studies investigating the long-run relationships among economic openness, trade and growth. Generally, those studies, which are usually based on a time-series framework and cointegration analysis, find evidence of a significant growth effect of international integration related factors.

Since we are trying to see if there is a cointegration relation between series of exports, imports and real GDP growth rate, we are going to use the Johansen cointegration test. Johansen cointegration test has two forms of tests, the *trace test* and the *maximum eigenvalue* test. Each of the form tests different null hypothesis but we should add that the *trace test* is more powerful than the *maximum eigenvalue* test. As we can notice from the results (Table 2.2.1) there is no cointegration present at 0.05 alpha level.

Table 2.2.1 Johansen cointegration test for Imports, Exports and the Log of real GDP of North Macedonia, data used are quarterly data, 1998-2017

Hypothesised numbers of CE(s)	Eigenvalue	Trace stat.	0.05 critical value	Probability
None	0.178020	21.11916	29.79707	0.3503
At most one	0.060220	6.024139	15.49471	0.6927
At most two	0.015997	1.241749	3.841466	0.2651

Source: calculations are done by authors using EViews9

In the cases when there is no cointegration present we can always do something else that is going to tell us if there is any time lag relationship among the given variables. In our case we have made a VAR system. But, if there was a cointegration between the variables then we would have proceeded with the VEC model to make the adjustment in the short run.

The standard errors of the VAR model are given in the small parentheses and the corresponding t-statistics are given in the medium parentheses.

Table 2.2.2 VAR coefficients of the model for Imports, Exports and log of the real GDP of North Macedonia, quarterly data, 1998-2017

	RIMP	REXP	LOGGDP
RIMP(-1)	-0.080470	0.069586	-2.92E-06
	(0.14188)	(0.12198)	(1.6E-06)
	[-0.56719]	[0.57046]	[-1.79101]
RIMP(-2)			
	0.586528	0.293002	6.24E-06
	(0.13919)	(0.11967)	(1.6E-06)
	[4.21397]	[2.44840]	[3.90033]
REXP(-1)			
	0.888005	0.797402	8.19E-06
	(0.17622)	(0.15151)	(2.0E-06)
	[5.03926]	[5.26307]	[4.04363]
REXP(-2)			
	-0.320784	-0.284884	-1.00E-05
	(0.20060)	(0.17248)	(2.3E-06)
	[-1.59910]	[-1.65173]	[-4.34929]
LOGGDP(-1)			
	8102.678	2821.828	0.516272
	(9302.04)	(7997.76)	(0.10692)

	[0.87106]	[0.35283]	[4.82845]
LOGGDP(-2)			
	2458.251	-2137.667	0.247248
	(9377.80)	(8062.90)	(0.10779)
	[0.26214]	[-0.26512]	[2.29371]
C			
	-113800.1	-8124.997	2.591112
	(94216.6)	(81006.1)	(1.08298)
	[-1.20786]	[-0.10030]	[2.39258]

Source: calculations are done by authors using EViews9

Most of the coefficients are statistically significant. From the model we can outline:

Imports are in positive dependency with two-time lags imports and one-time lag exports; this means that in a given period *ceteris paribus,* if imports before two quarters increased of one million denars (since the data are in million denars) then actual value of the imports would increase for 0.5865 million denars, and every increase in the exports for 1 million denars from one quarter before *ceteris paribus,* would increase the imports of actual quarter for 0.888 million denars.

For every increase of 1 million denars in the value of imports prior two quarters *ceteris paribus,* the actual value of exports would increase for 0.293 million of denars and for every increase for one million denars on the vaule of the exports prior one quarter the value of the actual exports would increase for 0.7974 million of denars, *ceteris paribus*.

The situation of real GDP growth rate is showing more dependency since the exports and imports are a component of the real GDP. For every increase of 1 million denars in the value of imports prior two quarters *ceteris paribus,* the actual value of GDP would increase for $6.24*10^{-4}$% and for every increase for one million denars on the values of the exports prior one quarter the value of GDP would increase for $8.19*10^{-4}$ %, *ceteris paribus*. The negative significant coefficient of exports prior to two quarters shows that for every increase for one million denars of exports from two quarters prior makes log GDP decrease for nearly $1*10^{-3}$%. The autoregressive part of the GDP is well known, so there is two lag and one lag dependency between actual values of logGDP and prior ones.

Conclusion

There is no cointegration relationship among exports import and real GDP. This shows that North Macedonia disobeys international budget constraints. The fact that these series are not co-integrated it means that they are not in the long run relationship thus making an unstable and increased trade deficit.

Not being able to make cointegration analysis we were not able to make the VECM model to see the short run response of the series, thus we made VAR model and the outcome is very intriguing. The autoregressive relation of the imports is very interesting and contradictory; on the other hand, the one period lag export making impact on the actual imports makes us think that for North Macedonia costs less to import things than to export which is also contradictory. The autoregressive part of the exports is more understandable, also it is very logical two period time lag of imports to have an impact on actual exports since as we know for most of the things North Macedonia that exports has to import parts, materials or technology. The growth rate of GDP (logGDP) is also autoregressive and also dependent on its prior category of exports and imports. It is very interesting the fact that coefficient of prior exports is negative, which means that it has

negative impact on growth rate of log GDP. The confusing results may be caused by the most participating category of GDP, which is the consumption of households.

There is needed further analysis with extended sets of data to see how exports and imports impact the economic growth, but the sure thing is that these series do not have a long run relationship. Granger causality test may be performed to see the two ways causal interdependency for future reference.

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