The Impacts of Research and Development Expenses on Export and Economic Growth

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Abstract

The purpose of this study is to identify the effects of research and development expenses on export and economic growth. Within this scope, annual data of 28 European Union member countries for the periods between 1996 and 2014 was taken into the consideration. Additionally, Dumitrescu Hurlin panel causality analysis was used in this study to achieve this objective. First of all, Im, Pesaran and Shin and Levin, Lin & Chu panel unit root tests were used to understand whether the variables are stationary or not. As a result of these tests, it was defined that the variable of economic growth is stationary whereas other two variables (export and R&D) are not. According to the results of Dumitrescu Hurlin causality analysis, it was determined that there is not a significant relationship between economic growth and R&D. On the other hand, it was concluded that there is a causality relationship from export to R&D expenses. This situation shows that EU member countries, which have higher export amount, give more importance to R&D in order to improve themselves.
INTRODUCTION

Especially after globalization, economic borders between the countries disappeared. In other words, as a result of the globalization, companies had a chance to access new markets. This situation increased the competition in these markets. Therefore, it can be said that companies should improve themselves to have higher profitability. Within this context, companies tried to search new ways in order to increase their competitive power (Drenzer, 2005).

Research and development (R&D) is a way of increasing effectiveness of the companies. Due to this condition, it can be seen that companies give more importance to R&D investment so as to achieve this objective (Mairesse, 2005). The main reason behind this situation is that it is possible to have technological improvement by increasing R&D investment. Hence, this issue brings a competitive advantage to these companies.

In addition to the advantageous of R&D investment for the companies, it also has some important benefits to the countries. First of all, when companies make higher R&D investment in a country, they will have a competitive power in international markets (Lefebvre et. al., 1998). That is to say, owing to the R&D investments of the companies, export amount of this country will increase. This situation will be helpful to decrease current account deficit problem which is accepted as a significant indicator of the financial crisis (Oktar and Yüksel, 2015).

Moreover, R&D investment is also beneficial for the countries so as to increase economic growth. First of all, R&D investment contributes economic growth by rising exports. Because export is the component of GDP, any increase in the export amount causes economic growth to go up. Additionally, it also improves economic growth by increasing investment in the countries (Goel et. al., 2008). The main reason for this aspect is that investment is also another component of GDP similar to the export.

Because of these advantages emphasized above, countries started to pay more attention to R&D activities. Within this scope, they encourage the companies to make R&D investment by providing some conveniences. For example, many countries decrease tax rates for the companies that make R&D investment (Bloom, 2002). Due to these incentives, it will be helpful to increase this investment and attract foreign investors.

According to World Bank report, it was seen that there was an important increase in R&D expenses. While the amount of total R&D expenses all over the world was 622 billion USD in 1996, this amount jumped to 1,621 billion USD in 2013. On the other side, US has the highest R&D expenses in the world. Although this amount was 197 billion USD in 1996, it exceeded 454 billion USD in 2013.

While considering these aspects, it was understood that studies related to R&D expenses of the countries are very important. Therefore, in this study, it was aimed to identify the effects of R&D expenses on the export and economic growth. Within this context, the data of 28 European Union member countries for the period between 1996 and 2014 was taken into the consideration. As a result of this analysis, it will be possible to understand whether R&D expenses have influences on export and economic growth. Hence, this study will make a significant contribution to the literature by helping to solve this problem.

This paper consists of four different parts. After the introduction, in the second part, similar studies in the literature will be analyzed. Furthermore, the third part gives information about the methodology and analysis. Finally, in the last section, analysis results and the recommendations will be discussed.
LITERATURE REVIEW

R&D expense is a very popular issue in the literature. Because of this aspect, it can be seen that there are lots of study in which this subject was analyzed. Some of these studies was detailed on table 1.

Table 1. Similar Studies in the Literature

<table>
<thead>
<tr>
<th>Authors</th>
<th>Scope</th>
<th>Method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galovic (2015)</td>
<td>OECD</td>
<td>Regression</td>
<td>R&amp;D has a significant influence on export amount.</td>
</tr>
<tr>
<td>Bozkurt (2015)</td>
<td>Turkey</td>
<td>Johansen Cointegration Analysis</td>
<td>There is a causal relationship between economic growth and R&amp;D expenditures.</td>
</tr>
<tr>
<td>Kuo and Su (2015)</td>
<td>US</td>
<td>Regression</td>
<td>R&amp;D expenditure has a positive and significant effect on economic growth.</td>
</tr>
<tr>
<td>Gümüş and Çelikay (2015)</td>
<td>52 different countries</td>
<td>Regression</td>
<td>R&amp;D investment plays a very significant role with respect to economic growth.</td>
</tr>
<tr>
<td>Edquist and Henrekson (2015)</td>
<td>Sweden</td>
<td>Regression</td>
<td>R&amp;D has a positive impact on economic performance of the countries.</td>
</tr>
<tr>
<td>Guarascio et. al. (2015)</td>
<td>EU</td>
<td>Regression</td>
<td>R&amp;D expenditures play a very significant role in order to increase economic growth.</td>
</tr>
<tr>
<td>Altuntas and Mercan (2015)</td>
<td>21 OECD countries</td>
<td>Panel Cointegration Analysis</td>
<td>R&amp;D has a positive contribution on economic growth.</td>
</tr>
<tr>
<td>Inekwe (2015)</td>
<td>66 developing countries</td>
<td>GMM</td>
<td>Export and R&amp;D expenditure have strong correlation.</td>
</tr>
<tr>
<td>Çetin and Cincera (2015)</td>
<td>EU</td>
<td>Probit</td>
<td>R&amp;D investment has a positive influence on economic growth.</td>
</tr>
<tr>
<td>Blanco et. al. (2016)</td>
<td>US</td>
<td>Panel Cointegration Analysis</td>
<td>There is a causality relationship between R&amp;D expenditure and economic growth</td>
</tr>
<tr>
<td>Bilas et. al. (2016)</td>
<td>EU</td>
<td>Granger Causality Analysis</td>
<td>There is a relationship between R&amp;D expenditures and economic growth.</td>
</tr>
<tr>
<td>Türedi (2016)</td>
<td>23 OECD countries</td>
<td>GMM</td>
<td>R&amp;D investment increases the productivity of the firms that provides a competitive advantage regarding export.</td>
</tr>
<tr>
<td>Vuong et. al. (2016)</td>
<td>Sweden</td>
<td>Regression</td>
<td>R&amp;D is an influencing factor of the export in Turkey.</td>
</tr>
<tr>
<td>Sungur et. al. (2016)</td>
<td>Turkey</td>
<td>Granger Causality Analysis</td>
<td>There is a strong correlation between</td>
</tr>
<tr>
<td>Altomonte et. al. (2016)</td>
<td>4 EU</td>
<td>Probit</td>
<td></td>
</tr>
</tbody>
</table>
Coad and Grassano (2016) EU Descriptive Statistics R&D investments play a key role for economic growth. Private R&D has stronger effect on economic growth in comparison with public R&D.

Hong (2016) Korea Granger Causality Analysis Private R&D has stronger effect on economic growth in comparison with public R&D.

Akçalı and Sismanoğlu (2015), Hadi and Suryanto T et.al (2016) made a study in order to define the relationship between economic growth and R&D expenditures. In order to reach this objective, 19 different countries were analyzed in this study. As a result of the regression analysis, it was determined that R&D expenditure has a positive and significant effect on economic growth. Similar to this study, Edquist and Henrekson (2015), Akçalı and Sismanoğlu (2015) and Guarascio et. al. (2015) also concluded that R&D investment plays a very significant role with respect to economic growth by using the same method.

In addition to those studies, Altıntas and Mercan (2015) tried to identify the relationship between R&D investment and economic growth. So as to achieve this objective, 21 OECD countries were taken into the consideration. Moreover, panel co-integration analysis was used in this study. They reached a conclusion that R&D expenditures play a very significant role in order to increase economic growth. Similarly, Bozkurt (2015) and Blanco et. al. (2016) also used the same method and concluded that there is a causal relationship between economic growth and R&D expenditures.

Furthermore, Inekwe (2015) evaluated the effect of R&D investment on economic growth. For this purpose, general method of moment approach was used for 66 developing countries. As a result of this analysis, it was identified that R&D has a positive contribution on economic growth. Türedi (2016) also reached similar conclusion by using the same method for 23 OECD countries. Additionally, Bilas et. al. (2016) and Hong (2016) underlined the same conclusion with the help of Granger causality analysis.

On the other side, it was also seen that there are also some studies in which the relationship between R&D investment and export was analyzed. Vuong et. al. (2016) and Suryanto T(2016), made a study in order to analyze this relationship in Sweden. According to the results of the regression analysis, it was identified that R&D investment provides a competitive advantage regarding export. Moreover, Galovic (2015) and Kuo and Su (2015) reached the similar conclusion by using the same method.

Additionally, Altomonte et. al. (2016) tried to determine whether R&D investment has an influence on export or not. Within this scope, 4 EU countries were taken into the consideration. As a result of the probit analysis, it was concluded that there is a strong correlation between export and R&D expenditures. Parallel to this study, Çetin and Cincera (2015) also emphasized this conclusion with the help of the same method. In addition to them, Sungur et. al. (2016) identified that R&D is an influencing factor of the export in Turkey by using Granger causality analysis.

As it can be seen from table 1, there are lots of studies in which the effects of R&D investments on economic growth and export amount were evaluated. It can also be understood that different methods were taken into the consideration in order to achieve this objective, such as regression, Granger causality analysis, Johansen co-integration analysis, general methods of moment and probit approaches. Therefore, it can be said that there is a need for a study that analyzes this relationship by using a new and original method.
RESEARCH AND APPLICATION

Data and Scope

The aim of this study is to define whether R&D has influence on export and economic growth. For this purpose, the data of these three variables for the periods between 1996 and 2014 was provided from the website of World Bank. In addition to this situation, all 28 member countries of European Union were analyzed in this study. Additionally, Eviews 8.0 program was used in all analysis.

Dumitrescu Hurlin Causality Analysis

Dumitrescu Hurlin causality analysis is the advanced form of Granger causality analysis. The main benefit of this method is that it is appropriate for panel data. The main prerequisite of this method is that variables, which will be used in the analysis, should be stationary (Dumitrescu and Hurlin, 2012). The details of this test were explained on the following equation.

\[ Y_{i,t} = a_i + \sum_{k=1}^{K} Y_{i,t-k}^{k} + \sum_{k=1}^{K} B_{i,k}^{k} X_{i,t-k} + \epsilon_{i,t} \]  

(1)

In this equation, the causality relationship between the variables Y and X is analyzed. In addition to this situation, “i” represents the number of panel. Moreover, “K” demonstrates optimum lag interval and “\( \epsilon \)” shows the error term.

Analysis Results

Before starting causality analysis, first of all, panel unit root test results were performed in order to understand whether the variables are stationary or not. Within this scope, Im, Pesaran and Shin and Levin, Lin & Chu panel unit root tests were used so as to reach this objective. The results of these tests were given on table 2.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Im, Pesaran and Shin W-stat (p Value)</th>
<th>Levin, Lin &amp; Chu Test (p Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export</td>
<td>0.9954</td>
<td>0.4204</td>
</tr>
<tr>
<td>Economic Growth</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>R&amp;D Expense</td>
<td>0.9998</td>
<td>0.2995</td>
</tr>
</tbody>
</table>

As it can be seen from table 2, it was identified that the probability values of economic growth are less than 0.05 in both two different tests. Thus, it can be said that this variable is stationary on its level value. On the other side, it was also determined that probability values of export and R&D expense are higher than 0.05. This situation shows that they have unit roots. Because they are not stationary, the first differences of these variables were used in the analysis. In order to understand the effects of R&D expenses on export and economic growth, Dumitrescu Hurlin causality analysis was used. The details of this analysis were given on table 3.
Table 3. Dumitrescu Hurlin Panel Causality Test Results

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Prob Values (lag=1)</th>
<th>Prob Values (lag=2)</th>
<th>Prob Values (lag=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“R&amp;D” does not cause “Export”</td>
<td>0.7525</td>
<td>0.9937</td>
<td>0.6562</td>
</tr>
<tr>
<td>“Export” does not cause “R&amp;D”</td>
<td>0.0217</td>
<td>0.2008</td>
<td><strong>0.0105</strong></td>
</tr>
<tr>
<td>“R&amp;D” does not cause “Economic Growth”</td>
<td>0.1124</td>
<td>0.8567</td>
<td>0.9754</td>
</tr>
<tr>
<td>“Economic Growth” does not cause “R&amp;D”</td>
<td>0.8023</td>
<td>0.5067</td>
<td>0.1974</td>
</tr>
</tbody>
</table>

Table 3 gives detailed information about causality relationship between these variables. In this analysis, when probability values are less than 0.05, the null hypothesis can be rejected and alternative hypothesis can be accepted. As it can be seen from table 3, the null hypothesis of ““R&D does not cause export” could not be rejected since the probability values for each lag is more than 0.05. This situation explains that there is not a significant conclusion that R&D influences export amounts.

In addition this situation, it can also be understood from table 3 that the null hypothesis of “R&D does not cause economic growth” could not be rejected. The main reason behind this condition is that probability values of this hypothesis for each lag is higher than 0.05. Similar to this aspect, it was also defined that the probability values of the null hypothesis “Economic growth does not cause R&D” are more than 0.05, so this hypothesis also had to be accepted. These results refer that the significant causality relationship between economic growth and R&D could not be found.

Moreover, it was also determined that the probability values of the null hypothesis “Export does not cause R&D” are less than 0.05 for the lags 1 and 3 although this value is higher than 0.05 for lag 2. While considering these numbers, it can be understood that this hypothesis can be rejected for these lags. These results mean that export is the main cause of R&D expenses. In other words, it was identified that EU member countries, which have higher export amount, give more importance to R&D in order to improve themselves. Neves and others (2016), Aw and others (2008) and Çetin and Cincera (2005) reached also similar results in their studies.

CONCLUSION

In this study, it was aimed to determine the effects of R&D investment on export amount and economic growth. Within this context, annual data of 28 European Union member countries for the periods between 1996 and 2014 was taken into the consideration. In addition to this issue, Dumitrescu Hurlin panel causality analysis was used in this study so as to achieve this objective.

In the first stage of the analysis, unit root test was performed in order to understand whether the variables are stationary or not. Within this scope, Im, Pesaran and Shin and Levin, Lin & Chu panel unit root tests were used. As a result of these tests, it was identified that the variable of economic growth is stationary whereas other two variables (export and R&D) have unit roots. Because of this situation, the first differences of these variables were used in the causality analysis.

After that, Dumitrescu Hurlin causality analysis was used to understand the relationship between these variables. According to the results of this analysis, it was determined that there is not a significant relationship between economic growth and R&D. On the other side, it was identified that export is the main cause of R&D expenses. In other words, it was identified that EU member countries, which have higher export amount, give more importance to R&D in order to improve themselves.

Especially in the last years, companies started to give more importance to R&D in order to increase the efficiency. Also, most of the countries encourage the companies for this situation by
decreasing tax rate and increasing subsidies. Thus, it is obvious that studies that analyze R&D are very important. Similar to this issue, the results of this study explain the relationship between R&D with export and economic growth. Because of this aspect, it can be said that this study made an important contribution to the literature by helping to explain this condition.

REFERENCES

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