The determinants of high technology product export in brict countries: an econometric approach

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Abstract

The aim of this study is to investigate the relationship between R&D expenditures, patent acceptance, openness and high technology product export. For this purpose, using panel FMOLS method, we examined BRICT (Brasil, Russia, India, China, Turkey) countries over the period of 2000-2011. According to the results, in the long run, all variables have positive impact on high technolgy product export. In the light of the findings obtained from the analysis, we present some policy recommendations in the conclusion.

Keywords: HighTechnology Product Export, R&D, Panel FMOLS.

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1. Introduction

High technology is mostly used when it is talked about goods and services of the firms and industries that contain innovation and technology (Keeble & Wilkonson, 2000). High technology products are R&D intense goods like aviation, computer, medical products, scientific materials and electronic devices (World Bank, 2014).

Economic development and sustainability of countries depend on lots of factors. Having high technology sectors, efficiency in value-added import and export, high technology production are some of these important factors. Efficiency in high technology is seen as one of the driving forces of economic growth and development especially for the countries that its strategy is to grow with export (Hobday, 2001). Today, increasing the percentage of high technology products in total products and increasing its productivity are some of the essential tasks of countries that grow fast in order to compete in new and high technology industries.

Producing its own technology and exporting this technology is some of the facts that show the countries' development level. Most of the countries are inefficient at this point and this cause the development problem. The countries that can produce their own technologies increase their production level and realize their growth plans. Least developed countries and developing countries need to positive progress of high technology on the economies in order to increase their production and reach the developed countries level. High technology production and export depend on lots of factors. In this study, it is examined the openness, R&D expenditures and patent applications as the factors affect the high technology export.

2. Literature Review

Today, high technology product export is one of the most discussed issues both in Turkey and world. And it is also a very popular subject among researchers. In this respect, the literature is summarized by categorizing as three parts and it is examined the relationship between export of high technology products and the important inputs: openness, R&D expenditures and patent applications. Furthermore it is given places out of traditional knowledge.

Landesmann and Pfaffermayr (1997) analyzed OECD members by using the variables from 1967 to 1987. They found that R&D expenditures in America, England and Japan have positive effect on export while in Germany and French there is a negative relationship between R&D expenditures and export. They said the underlying reason is that increasing R&D expenditures can cause diminishing returns in the economy. Ulku (2004), examined the relationship between R&D, innovation and GDP per capita for the variables of 20 OECD members and 10 non OECD members in the period of 1981-1997 by using the panel data analysis. He concluded that while in both of two country group there is a positive and strong relationship between innovation and GDP per capita, in OECD members, innovations are supported by R&D expenditures. Ozer and Çiftçi (2009), studied on the relationship between R&D expenditures and export, data communication technology export and high technology export for 19 OECD countries in the period of 1993-2005 by using panel data analysis. According to the result of analysis, they found that R&D expenditures affect export and high technology export positively. Bojnec and Ferto (2011) examined the relationship between R&D expenditures and manufacturing industry export for 18 OECD members for the period of 1995-2003 by using gravity model. As a result of the study, they said that there is a positive relationship between R&D expenditures and manufacturing industry. Yıldırım and Kesikoğlu (2012) analyzed the relationship between R&D expenditures and export for 25 sub-sectors in Turkey by using the variable in the period of 1996-2008. As a result of the study, it is found that while there is a casual relation from R&D expenses to export, it is not in the question a casual relation from export to R&D expenses.

Number of patent in a country or in a firm shows its innovative strength and how many inventions are done. In this context, if the number of patent is abundant in a country, it means that R&D

mechanism is successful in that country (Unal & Seçilmiş, 2013). Patents which are the criteria of R&D output provide that the innovations turn into commercial product and cause producer to gain. Maskus and Penubarti (1995), found a positive relationship between patent and high technology as a result of their study which they use panel data analysis with the variable of 77 countries for the year of 1984. This study leads a lot of studies in this area. Rafiquzzaman (2002) examined Canada's export to 76 countries in 1990 and determined a positive relation between patent rights and high technology export. In their study, B. Xu& E, Chiang (2005) searched the international technology distribution on 48 countries' examples with the number of trade and patent acceptance between the years 1980 and 2000. As a result, they found that rich countries benefit from the domestic and foreign technology by imported capital goods, middle income countries benefit from the technology by imported capital goods and externality of foreign patents and lastly lower income countries generally benefit from the foreign patent and technology. Belay (2005), examined the relation between export of high technology products and per capita R&D expenses, number of scientists and engineers in R&D activities, equipment of buyers and foreign direct investments. And they found that all variables have positive effect on export of high technology products. However, they state that especially in countries which have low technology capacity and R&D intense, most efficient variable is foreign direct investment.

In addition to categorized literature above, some studies state that in order to increase the export of high technology product, countries must focus on human capital. For example Swift (2006) examined the relationship between the human capital and export of high technology product. He analyzed the variable of 8 countries for the period of 1950-2000 by using panel data analysis. According to the findings, human capital is a deterministic variable for the export of high technology product. Xing's (2012) study stated that the indicators which show that China is a world leader in export of high technology product are untrue since they use old trade variables and wrong product classification. He supported this idea by claiming that generally it is utilizing imported inputs in high technology product. Also he said that these products must be named as 'joining high technology'. There are many views on that it necessary to increase private sector R&D expenditures in order to high technology product export. Karahan (2015), examined if the added value of private sector R&D expenditures is high technology product inputs or not. In the study it was analyzed the variable of 2000-2013 with GMM method. According to the findings of analysis, the increase in private sector R&D expenditures is the main source of production of high value-added products in Europe and there is a strong relationship between these two variables.

3. Econometric Analysis

In this study, it is examined the effect of openness, R&D expenditures and patent acceptances on the high technology product export by using linear regression model in panel data format.

$\ln T_{it} = \alpha_{0i} + \alpha_{1i}\ln OPEN_{it} + \alpha_{2i}\ln P_{it} + \alpha_{3i}\ln RD_{it} + u_{it}$

i=1, …..,n ve t=1, ……,t   (1)

Here, InT is for high technology product export (current prices, US$), InOPEN is for openness ((import+export)/GDP), InRD is for research and development expenses (R&D/GDP) and InP is for patent applications. Data set used in the analysis is from the time period of 2001-2011 and the analysis includes BRICT (Brazil, Russia, India, China and Turkey) countries. All variables obtained from World Bank Development Indicators.

Table 1. Panel Unit Root Test Result

Variables	LLC Test		IPS Test	
	Statistical Value	Prob. value	Statistical Value	Prob. Value
T	0,76547	0,7780	1,35516	0,9123
OPEN	-1,51291	0,0652	0,02055	0,5082
P	4,22631	1,0000	4,57592	1,000
RD	0,34492	0,6349	1,55231	0,9367
ΔT	-3,00526	0,0013	-1,46737	0,0711
ΔOPEN	-6,0300	0,0000	-3,32177	0,0004
ΔP	-5,71984	0,0000	-2,92624	0,0017
ΔRD	-2,66224	0,0039	-1,56079	0,0593

Δ is the first difference operator.

Test unit root test results show that variables are non-stationary at level form but they are stationary at first difference [I(1)]. In this case, cointegration relationship between the variables in the long run must be tested. If there is a cointegration between variables, the obtained results will be reliable.

Table 2. Pedroni Panel Cointegration Test Results

Test	Constant	Constant and trend
Panel v-Statistic	1,071600	5,636168
Panel rho-Statistic	1,032335	1,668560
Panel PP-Statistic	0,363351	-5,337250
Panel ADF-Statistic	2,352331	-0,464183
Panel rho-Statistic	1,953647	2,694329
Group PP-Statistic	-0,146901	-1,436576
Group ADF-Statistic	1,296334	0,654427

According to the test result, in the constant model, four of seven statistics shows that null hypothesis is rejected at 1% significance level. In constant and trend model, four of seven statistics shows that null hypothesis is rejected at 1% significance level. These results strengthen that variables are cointegrated in the long run.

3.1 Estimation of Panel Cointegration Coefficients

After estimating the panel cointegration relation, the next step is to estimate the long run cointegration coefficients. Therefore, it is used panel fully modified ordinary least squares (FMOLS) which developed by Pedroni (2000, 2001). FMOLS estimator developed as a result of deviant results in the situation of estimating data sets that have long run relationship in between by least square method. FMOLS method, corrects the autocorrelation and the internality problem with a non-parametric approach. Table 3 shows the panel FMOLS results.

Table 3. Panel Cointegration Coefficients (lnT is dependent variable)

Variables	Panel FMOLS
lnRD	0,048
	[2,03]
lnP	0,00
	[4,13]
lnOPEN	0,00
	[6,10]

The values in [ ] are t statistics.

According to the test results, openness (InOPEN), R&D expenditures (InRD) and patent applications (InP) have positive effects on high technology product export, with 1% significance level in FMOLS estimations.

5. Conclusion

In this study, the effects of openness, R&D expenditures and patent applications on the export of high technology products of Brazil, Russia, India, China and Turkey called BRICT countries are examined in 2001-2011 period. In examination Panel FMOLS method is used. Selected countries are can be entitled as emerging markets in accordance with their economic indicators (Sandalcılar, 2012).

Pedroni Co-integration Test is used to determine whether there is a long-run relationship between variables. As a result of the test, there is a long-run relationship between variables. In the analysis, 2001-2011 period is examined and FMOLS method is used to obtain the coefficients of long-run co-integration relationship. As a result, openness, R&D expenditures and patent applications are positively related with the export of high technology products.

Within the results, variables affecting high-tech product exports are very important for developing countries for the sake of reaching targeted development level. In order to increase the high-tech product exports, governments should implement stimulus packages. In addition, governments should provide convenience to domestic and foreign companies in terms of taxes etc. of high-tech products.

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