Esra Kabaklarli
Selcuk University
Faculty of Economics and Administrative
Department of Economics, Konya,Turkey
E-mail: etalasli@selcuk.edu.tr

Mahmut Sami Duran
Selcuk University
Yunak Vocational School
Department of Finance Banking and Insurance, Konya,Turkey
E-mail: msduran@selcuk.edu.tr

Yasemin Telli Üçler
Konya Necmettin Erbakan University
School of Applied Sciences, Department Of Transportation & Logistic, Konya, Turkey
E-mail: ytelliucler@konya.edu.tr

THE DETERMINANTS OF HIGH-TECHNOLOGY EXPORTS: A PANEL DATA APPROACH FOR SELECTED OECD COUNTRIES

Preliminary communication
UDK: 339.564:004
JEL classification: O30, O40, L63, F14, C33

Abstract

This paper uses a panel data approach to analyze the determinants of high-technology exports in selected OECD countries between the years 1989 to 2015. We used High-technology exports (current US$) as dependent variable and FDI (foreign direct investment), patent application of residents, GDP growth rate and Gross capital formation - % of GDP as explanatory variables. The export structure of countries is increasingly moving towards technology-intensive products such as ICT (information, communication technology), aerospace, computing and office equipment, electronic, chemical products, pharmaceutical electrical machinery. The Export structure had an important role in the economic growth theories of many countries since the 1960s, as export growth has been associated with faster productivity and GDP growth. We aimed to find out the relationship between the high-technology exports and explanatory variables which we listed for selected 14 OECD countries (Canada, Denmark Finland, France, Germany, Israel, Korea, Netherland, Norway Switzerland, Sweden, Turkey, UK, USA).

Keywords: High Technology Export, GDP Growth, FDI, Panel Cointegration

1. INTRODUCTION

One of the reasons underlying economic growth and income level differences between developed and developing countries is undoubtedly the technology infrastructures these countries have. The workforce, natural resources, economic and political stability, educational status, density of R&D activities, innovation etc. in the country, while many factors lead to differences in development and growth among countries, the most important factor is the technology on which production is based.

High Technology (high tech) is used to express goods and services with innovative and advanced technology companies and industries. Such firms are generally firms that are reliant on advanced scientific and technological expertise and are generally characterized by high R&D spending (employment) in their labor force (total labor force). High technology sectors; Aerospace, computers, pharmaceuticals, scientific instruments and electric machines. Countries that have developed advanced technology infrastructures in these sectors can finally achieve better levels of economic growth.

The OECD has classified for different way of exports - high, medium-high, medium-low and low-technology. "*The classification is based on the importance of expenditures on research and development relative to the gross output and value added of different types of industries that produce goods for export. Examples of high-technology* industries are aircraft, computers, and pharmaceuticals; *medium-high-technology* includes motor vehicles, electrical equipment and most chemicals; *medium-low-technology* includes rubber, plastics, basic metals and ship construction; *low-technology* industries include food processing, textiles, clothing and footwear"(OECD,2011).

Many countries that want to be in a better position as economic growth and development level are now paying more attention to technology-based industrial development. New Silicone Voyages have begun to be established in many countries of the world. Especially considering the developments in the last two decades, we are aware that many Western European countries are starting to establish venture centers in newly established universities.

In recent years, the rapidly increasing use of high technology in the world and high-tech base production has made it possible to accelerate the export of high technology. The ability of emerging countries to rise to the level of developed countries depends on the size of the High Technology Exports that these countries can make. It is important for developing countries to rapidly focus on quality education and R&D activities, to produce and export high-tech products.

The aim of working in this context is; analyzing the determinants of high-tech exports (foreign direct investment, domestic patent applications, investment) in selected OECD countries (Canada, Denmark Finland, France, Germany, Israel, Korea, Netherland, Norway Switzerland, Sweden, Turkey, UK, USA) by using panel data approach. For this purpose, the study was formed in

the following way. In the introduction section, we mentioned definition of high-tech product, in the second section, we examined literature related to the study, and the theoretical framework of the study in the third section is presented. In the fourth part of the study, dataset, model and method were introduced and evaluations about the results of the study were made. In the conclusion part of the study, policy proposals were presented through empirical findings and determinations.

2. LITERATURE

Since the 1960s, export growth has played a central role in many countries' economic growth strategy; Because export growth is associated with faster productivity and GDP growth (Bernard and Jensen, 2004). Growth analysis of exports and its general economic effects have been an important topic in the economic literature in the last decade. However, more recently, As researchers began to understand the relationship in between innovation, high-technology-based international trade and overall economic performance, they focused more on high-tech trade (Tebaldi, 2011, p.343).

This growing interest in high-tech trade is largely due to the fact that an economy of international commerce of high-tech products informs about general competitiveness and its position in the global technology market. This interest also contributes to how innovation in a dynamic economic environment affects its comparative advantages and the relative importance of high technology to international markets (Tebaldi, 2011, p.344).

The literature highlights that high tech industries are the most developing industries in international trade. It contributes to boosting its performance in other sectors through the dynamism and positive externalities that it unfolds. In this sense, studies on High Technology Exports and High Technology are given below.

Hatzichronoglou (1997), in the context of economic globalization, stated that technology is an important factor in growing business and increasing competitive power. Technology-intensive manufacturing firms are creating more innovation, entering new markets and using existing resources more productively, resulting in higher pay for people they employ.

Srholec (2007) found that the technological capabilities of a country, gross enrolments in tertiary education, the number of patents and the amount of computer access, have positive effects on high technology exports. In addition, the size of the economy plays an important role in High Technology Exports. According to Srholec (2007) findings, developing countries attract manufacturing-based fragments of global production networks in electronics, developing countries must focus on high specialization of in electronics.

Braunerhjelmand Thulin (2008) show that R&D investments are a key factor in determining high-tech exports among OECD countries, and that market size is not an effect of high-tech trade.

Lee and Hong (2010) analyzed the period between 1970 and 2004, the economies of 71 countries. Lee and Hong, according to the countries that have been exporting traditional and low-tech products, the countries that have been exporting high-tech products achieved the result of faster economic growth.

Tebaldi (2011) describes the determinants of high-tech exports from 1980 to 2008 using a panel dataset. This research is the result of human capital, foreign direct investment inflow and international trade openness being the main factors affecting the global market performance of a country's high-tech industry. At the same time, it also shows that institutions are not directly contributing to high-tech exports. This article also shows that gross capital formation, savings and macroeconomic volatility have no significant impact on high technology exports.

Göçer (2013) examined the relationship between R&D expenditure and high-tech products, the effects of high-tech exports on foreign trade and economic growth, using data from 1996-2012 in a study of 11 emerging Asian countries. As a result of this study, it has been determined that R&D expenditures have a positive relationship between high-tech products and high-tech product exports have increased economic growth.

Ismail (2013) examined the impact of innovation work on high tech exports in 10 Asian countries (Hong Kong, India, Malaysia, Singapore, Thailand, Japan, China, Korea, Indonesia, Philippines) in his 2004-2009 study. As a result of the study, it was determined that innovation activities increased high-tech product exports and were a very important factor on exports.

Kılıç, Bayar and Özekicioğlu (2014) examined the relationship between R&D expenditures and high-tech exports in the G8 countries from 1996 to 2011. R&D expenditures and real exchange rates have been found to have a positive effect on exports of high technology products.

Akhvelediani and Sledziewska (2015) used panel data analysis for the years 1999-2011 on the basis of the generalized gravity model, for Visegrad countries (V-4: Czech Republic, Poland, Slovakia, Hungary) and the core countries of EU 15, have tried to explain the determinants of technology exports. Although the effect of accumulation of physical and human capital on export growth for the EU-15 countries is similar, it has a positive effect on the V-4 countries.

3. THEORETICAL FRAMEWORK

It is known that development strategies directed towards exports have a positive impact on economic growth, as they increase efficiency and productivity in resource distribution, increase market size and increase foreign direct investment. In this sense, it is important to increase exports in many developing countries that want to catch industrialized countries. If exports have an effect on the growth channel, undoubtedly the biggest effect is the production

and marketing of high technology products. This point is also crucial for the countries to export to high technology and concentrate their investments in these fields.

"High Technology" is used to represent companies and industries that represent cutting-edge technologies, products or services that are innovative. These companies are commonly credited with advanced scientific and technological expertise and are generally characterized by high turnover (total work force) and high R&D expenditure (employment) (Seyoum, 2004, p.145).

Davis (1982) showed the first systematic effort in the sense of measuring the high-tech combination. The products produced by high-tech producers have been identified as the products with the highest R & D expenditure according to the value of the senders. Davis has identified the top 10 products as high-tech, in order, from technology density to lowest rank. The second definition of High Technology was made by Hatzichronoglou (1997). He has prepared a list of high-tech products. This list is the result of calculations of AR-GE intensity (AR-GE spending / total sales) covering six countries (USA, Japan, Germany, Italy, Sweden, Netherlands). Finally, the OECD has identified the best definition of products as advanced technology (Seyoum, 2004, p.146).

The empirical descriptions of high-tech products overlap at large. Although the literature has been developed differently, different definitions have been made, according to the definition made by OECD, high-tech products are listed as space, computer and office equipment, electronics and telecommunication, scientific instruments, chemical products, drugs, weapons, electrical and non-electrical equipment.

With the rapid development of communications and transportation technologies along with the decline in costs over the 1960s, the world economy has entered a period of rapid globalization. In such a period, developed economies opened their economies more quickly in international trade, while export increases in East Asian countries were influential in the opening of emerging economies to international trade (Balcilar et al., 2014, p.451). Today, many western countries have begun to develop their production with a focus on technology-based industrial growth as a result of such a growth and competitive environment brought by globalization. These countries, which can make good use of the advantages arising from technology-intensive production, have come to assume a better position in international trade.

On the other hand, in today's global economy where globalization is growing and competition is intense, countries can only export if they can produce appropriate quality products with high quality products (Özer and Çiftçi, 2009, p.42). Given that the world economy's greatest share in the composition of international trade in the last two decades is the high-tech products, the production of these products has been vital to sustaining global competition.

An achievement in High Tech Exports is often seen as a measure of the competitiveness of industries in a country. Markets for high-tech products is growing faster than other products, the reason is that as the income elasticity of

demands, product innovation and productivity increase is higher. If a competitive position can be achieved in high-tech products, it is easier for ancountry to sustain its export growth (Mani, 2004, pp. 26-27).

The competitive position of a country in high technology exports is linked to various factors. If we move from general literature; factor conditions of an individual country, amount of direct foreign investment, domestic competition environment, demand conditions and exchange rates, patent applications, R&D expenditures, innovation etc. many factors play an important role in high technology exports of the country.

Factor conditions, human, physical information and capital resources and the type, quality and usability of the infrastructure allow the competition to be realized. The creation of advanced technology factors (highly skilled human resources, research centers and communication infrastructure) is considered to have critical importance for creating and developing competitive advantage in technology intensive sectors. Therefore, the higher the number of scientists and engineers involved in a country's R&D, emphasis on mathematics and scientific training, R&D business associations with other countries and the state of modern physical infrastructure, the higher the exports of high technology (Seyoum, 2004, pp. 150-151).

Foreign direct investment is considered as one of the factors contributing to the economic growth and development of the developing countries. Foreign direct investment contributes to the growth rate of the countries to which it has gone and increases its competitiveness in production and international arena. Multinational corporations are also making technology transfers that countries can not achieve on their own, by investing in countries where labor is relatively cheaper. By using this transferred technology, the related country can increase the high technology exports (Kızılkayavd., 2017, p.67). For this reason, it is also important that high-tech investments and direct exports to the country are directed towards high-tech areas.

The presence of strong local competitors is a strong stimulus to the creation and continuity of national competitive advantage. The intensive domestic competition will ultimately create pressure to replace domestic firms and, at the same time, to look at global markets. Such violent competition will force domestic companies to succeed in international markets.

As a result of the R&D expenditures realized by the countries, technological advances and increases in the level of realized production processes are emerging. These technological developments that as a result of R & D activities arise capital accumulation, invention, innovation, efficient use of resources, etc. It manifests itself in the form of utilities. These increased benefits and technological advances as a result of the R & D work carried out by the countries are being used both to raise demand in domestic markets and to increase exports. Moreover, there is a positive relationship between R & D expenditures and patent applications, and studies have been carried out in which the patent applicants contribute to the increase in high-tech exports (Kızılkayavd., 2017, p.67).

On the other hand, it is seen in the literature studies that the increasing innovation activities as a result of these R & D studies contribute to the diversification of exports. There is a positive relationship between R & D expenditures and patent numbers and innovation. An increase in product technology content with increased innovation, production of new products and production of new and added value products will have a positive effect in terms of diversification and increase of exports (Ferragina and Pastore, 2007, pp.4-5).

4. DATA AND DESCRIPTIVE STATISTICS

Our data set covers annual data from the 1989-2015 period for 14 selected OECD countries (Canada, Denmark Finland, France , Germany, Israel, Korea, Netherland, Norway Switzerland, Sweden, Turkey, UK, USA). Table 1 denotes the definition of data set.

Table 1

Definition of data set.

Export	High-technology exports (% of manufactured exports)
Lngdp	GDP (current US$)
FDI	Foreign direct investment, net inflows (% of GDP)
İnvestment	Gross capital formation (% of GDP)
lnpatent	Patent applications, residents

Our dependent variable is high-technology exports (% of manufactured exports) which incorporate aerospace, computers- office machines, electronics-telecommunications, pharmacy, electrical machinery, non-electrical machinery. We also use foreign direct investments to GDP ratio,the natural logarithm of patent applications, Gross capital formation (% of GDP) proxy for investment. All of our data are obtained from the World Bank databank. Table 2 denotes the descriptive statistics.

Table 2

Descriptive Statistics

Variable	Obs	Mean Std. Dev.	Min	Max
lngdp	378	27.17361 1.267417	24.50	30.52
exports	378	18.47323 7.643881	0.99	35.80
fdi	378	3.451735 6.871879	-3.69	87.40
investment	378	23.12238 4.219917	14.70	41.30
lnpatent	378	8.588343 1.725721	4.92	12.57

4.1 Testing Cross-section Dependency and Unit Root

The first essential step in a panel data analysis is to find out whether there is cross-section dependence or not. OECD countries integrate each other in terms of international trade and financial transactions. Globalization, custom unions, economic unions and contagious financial crises make countries sensitive to economic shocks from other countries. Because of this integration in panel data analysis , we must consider possible cross-section dependence across countries (Zhong et al, 2015) .The following panel equation is estimated to manage the CD test for cross section dependency:

$$y_{it} = \alpha_i + \beta_i' x_{it} + u_{it} \text{ for } i = 1, 2, \ldots, N; t = 1, 2, \ldots, T \quad (1)$$

where *i* is the individual dimension, *t* is the time dimension, x_{it} is $k \times 1$ vector of explanatory variables, α_i and β_i are individual intercepts and slope coefficients, respectively, which are allowed to vary across states. The null hypothesis of no cross-sectional dependence- for all *t* and $i \neq j$ is tested against the alternative hypothesis of cross-section dependence . To test the null hypothesis, the CD statistic is:

$$\text{CD} = \sqrt{\left(\frac{2T}{N(N-1)}\right)}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \quad (2)$$

where $\hat{\rho}_{ij}$ is the sample estimate of the pair-wise correlation of the residuals from pooled ordinary least squares (OLS) estimation of equation (1) for each i(Pesaran,2004).

Data used in this paper are from 1989-2015. As a part of our analysis we checked each of this series for cross section dependency that the hypothesis of a cross section dependency could not be rejected for all the variables. Table 3 and table 4, denotes the cross section dependency and slope homogeneity tests results respectively.

Table 3

Cross Section Dependency CD test Results

Variable	CD-test	p-value
exports	20.85	0
lngdp	46.97	0
fdi	22.88	0
investment	9.34	0
lnpatent	8.16	0

Table 4

Slope Homogeneity Tests in Pesaran and Yamagata (2008)

	Statistic	p-value
Homogeneity tests:		
$\tilde{\Delta}$	13.35	0.000
$\tilde{\Delta}_{adj}$	15.06	0.000

The implications of unit roots in macroeconomic data are very intense. If a structural variable, such as GDP, is not stationary and I(1), then shocks to GDP will have enduring effects (Greene,2008). Before analyzing the determinants of high technological export we must check the stationary of the variables. We use cross- sectionallyaugmented ADF (CADF) unit root test which allow for the cross-section dependence to confirm variables are stationary or not (Pesaran 2007).

Table 5

Cross-sectionally augmented (CADF) Unit Root Test

	CADF-stat				
		Level			First Difference
	lag	Constant	Constant and Trend		
export	3	-2.045	-3.222***		
lngdp		-1.864	-2.171		-3.995***
FDI	3	-3.711***	-3.954***		
Investment	3	-2.066	-2.893**		
lnpatent	3	-2.013	-2.547		-4.713***
		10%	5%	1%	
Critical values	at constant[1]	-2.14	-2.25	-2.44	
Critical values	at constant and trend	-2.66	-2.76	-2.96	

***denotes the rejection of the null hypothesis at 1% level and ** the rejection of the null hypothesis at 5%, * the rejection of the null hypothesis at10%, level. The optimal lag length is chosen on the basis of the Schwartz Information Criterion

The panel unit root test statistics based on CADF regressions are summarized in Table 5. *CIPS statistics of CADF*test do not reject the null hypothesis of the unit root for lngdp and ln patent variables at 5% levels. When both a constant and a linear trend are included in the model, we could not reject the null at 5% and %1 for FDI, export and investment. As a result of unit root test; FDI, export and investment series are I (0) however the gdp and patent series are stationary at the level .

[1] Critical values for CADF statistics are based on Peseran (2007) p.281 Table II(b). And Table II (c)

4.2. Estimating Cointegration Between the Variables

As presented in Table 6, the results of Westerlund (2008) Durbin_ hcointegration test indicates that the null hypothesis of no – cointegration is rejected at 5 significance levels. After detecting a cointegration between the variables the, long-run parameters (cointegrating vector) should be estimated (Özcan and Arı,2015).

Table 6

Westerlund (2008) Durbin_hCointegration Tests

Tests	Statistic	Critical values	
WesterlundDurbin_h Tests, (Ho:Nocointegration)		1.28 1.645	10% 5%
dh_g	0.648		
dh_p	.709**	2.333	1%

The Pooled Mean Group (PMG) estimator is an approach of Pesaran et al. (1999) that enables to estimate the short and long-run parameters which can be shown in table 6 (Pesaran at all 2007). PMG estimator allows coefficients and error variances to differ freely across countries in the short run. However, PMG assumes long run homogeneity among the panel group. PMG estimator givesthe advantage to calculate error correction term which measures the speed of adjustment towards the long-run equilibrium.

Table 7

Results of Panel PMG and MG Estimation

Long-run coefficient	**PMGE**	**MGE**	**Hausman test**
lngdp	-2,61*** (0.001)	-4.25* (0.080)	2.76
FDI	0,39*** (0.000)	-0,13 (0,653)	(0.59)
investment	-0,28** (0.030)	-0,004 (0.987)	
lnpatent	3,47*** (0.006)	14.96*** (0.018)	
Error correction	−0,20*** (0.000)	−0,51*** (0.000)	

The null hypothesis of hausman test which asserts, MG and PMG are consistent, but MG is inefficient, is accepted according to prob value(0,59). After the hausman test results, we consider PMG analysis .

We used GDP and patent variables in logarithm form so, the long run coefficient gives us information on the elasticity of high tech export towards the

GDP and patent across sample countries. Our findings show that 1% increase in GDP will lead 2,61% decrease in high tech exports. According to our results GCF (investment) and high tech exports have a negative and significant relationship in the long run. Patent applications effect high tech exports positively. 1% increase in patent applications will lead 3,47% increase in high tech exports. FDI has a positive and significant impact on high tech exports.

5. CONCLUSION

Having a great deal of knowledge in high technology sectors such as aerospace, computers, pharmaceuticals, scientific instruments and electric machines give a comparative advantage to countries. High technological production contributes export value added to achieve better levels of economic growth for countries. Many countries that want to be in a better position in terms of economic growth and development level are now paying more attention to technology-based industrial development. New Silicone Voyages have begun to be established in many countries of the world.

We applied Pooled Mean Group Cointegration analysis for a selected group of OECD countries the years between1989-2015 to examine determinants of high-technology exports. As a result of our findings, FDI and patent applications have a positive and significant impact on high tech exports. Contrary to the economic literature, GDP growth has not been associated with high tech export growth. As a conclusion, countries must focus on innovation such as patent applications and foreign direct investment to stimulus high tech export. Our findings are parallel with the findings of Kızılkaya et al., (2017), Srholec (2007) who assert new patent applications and FDI contribute to high tech exports.

Error correction term which measures the speed of adjustment towards the long-run equilibrium is negative and significant. It means that existence of a long run high tech and other explanatory variables relationship and that the short run is driven by the extent of the gap between short.and long run values.

The empirical results show that improvement of, patent applications, and foreign direct investment play a decisive role in upgrading selected OECD countries high tech exports, while growth rate and investment playnegative role in enhancing these countries high tech exports. FDI lead to knowledge and technology spillovers to local firms in the same industry or across the industries. There are many studies which conclude the positive effects of FDI on increasing host country's high tech exports.

Based on the above conclusions, we have the following policy recommendations. First, developing countries must focus on enhancement of the "innovation strategy" through designing well-structured patent policies. Second, they must make structural reforms to attract FDI to their countries.

REFERENCES

Akhvlediani, T., Śledziewska, K. (2015). What Determines Export Performances in High-tech Industries?. Working Paper Delab UW, NR 05

Balcilar, M., Bal, H., Algan, N., Demiral, M. (2014). Turkey's Export Performance: Examining the Main Determinants of Export Volume (1995-2012). EgeAkademikBakis, 14(3), 451.

Bernard, A. B., Jensen, J. B. (2004). Exporting and productivity in the USA. Oxford Review of Economic Policy, 20(3), 343–357.

Braunerhjelm, P., Thulin, P. (2008). Can countries create comparative advantages? R&D expenditures, high-tech exports and country size in 19 OECD countries, 1981–1999. International Economic Journal, 22(1), 95-111.

Ferragina, A. M., Pastore, F. (2007). High tech export performance: which role for diversification? In Ninth annual ETSG conference. 13-15.

Göçer, İ. (2013). Ar-Ge Harcamalarının Yüksek Teknolojili Ürün İhracatı, Dış Ticaret Dengesi ve Ekonomik Büyüme Üzerindeki Etkileri. Maliye Dergisi, 165(2), 215-240. In Turkish

Greene, William H.(2008) Econometric Analysis, 7th Edition,Pearson Int. Edit,New York.

Hatzichronoglou, T. (1997). Revision of the high-technology sector and product classification.

Kılıç, C., Bayar, Y., Özekicioğlu, H. (2014). Araştırma Geliştirme Harcamalarının Yüksek Teknoloji Ürün İhracatı Üzerindeki Etkisi: G–8 Ülkeleri İçin Bir Panel Veri Analizi. Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, (44), 115-130. in Turkish.

Kızılkaya, O., Sofuoğlu, E., Ay, A. (2017). Yüksek Teknolojili Ürün İhracatı Üzerinde Doğrudan Yabancı Sermaye Yatırımları ve Dışa Açıklığın Etkisi: Gelişmekte Olan Ülkelerde Panel Veri Analizi. Doğuş Üniversitesi Dergisi, 18(1), 63-78. In Turkish.

Lee, J. W., Hong, K. (2010). Economic growth in Asia: determinants and prospects. ADB Economics Working Paper Series No. 220

Mani, S. (2004). Exports of high technology products from developing countries: are the figures real or are they statistical artefacts?. Innovation, Learning, and Technological Dynamism of Developing Countries, 12-47.

OECD (2011), Directorate for Science, Technology and Industry ,Economic Analysis and Statistics Division https://www.oecd.org/sti/ind/48350231.pdf, Access: 05.09.2017

Ozcan, B and Ari , Ayşe (2015) Does the Fisher hypothesis hold for the G7? Evidence from the panel cointegration testEconomic Research-EkonomskaIstraživanja Vol. 28 , Issn. 1.

Özer, M., ve Çiftçi, N. (2009). Ar-ge Harcamaları ve İhracat İlişkisi: Oecd Ülkeleri Panel Veri Analizi. Dumlupınar *Üniversitesi* Sosyal Bilimler Dergisi, 23, 39-49. in Turkish.

Pesaran, M. H. (2007), A simple panel unit root test in the presence of cross-section dependence. J. Appl. Econ., 22: 265–312.

Pesaran, M. H. 2004. "General Diagnostic Tests for Cross Section Dependence in Panels." Cambridge Working Papers in Economics No. 0435.

Seyoum, B. (2004). The role of factor conditions in high-technology exports: An empirical examination. The journal of high technology management research, 15(1), 145-162.

Srholec, M. (2007). High-tech exports from developing countries: A symptom of technology spurts or statistical illusion? Review of World Economics/WeltwirtschaftlichesArchiv, 143(2), 227–255.

Tebaldi, E. (2011). The determinants of high-technology exports: A panel data analysis. Atlantic Economic Journal, 39(4), 343-353.

Wana Ismail, N. (2013). Innovation and High-Tech Trade in Asian Countries.International Conference on Recent Developments in Asian Trade Policy and Integration. The Kuala Lumpur Teaching Centre, The University of Nottingham Malay.

Zhong, M, Chang, Tang D. P and Rufael, Y (2015). The causal nexus between military spending and unemployment in the G7: a bootstrap panel causality test,, Defence and Peace Economics Vol. 26 , Iss. 6,