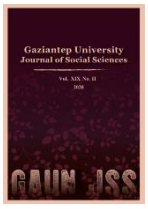

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Araştırma Makalesi ● Research Article

The Relationship Between High-Tech Export and Economic Growth: A Panel Data Approach for Selected Countries

Yüksek Teknoloji İhracatı ve Ekonomik Büyüme Arasındaki İlişki: Seçilmiş Ülkeler İçin Panel Veri Yaklaşımı

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ÖZ

Çalışmada, yüksek teknoloji ihracatı, tarım ihracatı ve ekonomik büyüme arasındaki ilişki, panel veri analizi yöntemi kullanılarak, ihracata dayalı büyüme hipotezi bağlamında analiz edilmektedir. Bu çalışmada, 20 yüksek teknoloji ihracatçısı ülke seçilmiştir. Bu ülkeler Belçika, Kanada, Çin, Çek Cumhuriyeti, Fransa, Almanya, Hindistan, İrlanda, İtalya, Japonya, Kore, Malezya, Meksika, Hollanda, Polonya, Singapur, İsviçre, Tayland, Birleşik Krallık ve ABD'dir. Analizde kullanılan veriler 2007-2018 dönemini kapsamaktadır. Analiz sonuçları, yüksek teknoloji ihracatının, ekonomik büyümeyi tarımsal ihracattan daha fazla artırdığını göstermektedir. Politika yapıcılar uçak, helikopter, nükleer reaktör, uzay aracı, otomobil ve bileşenlerinin üretimine yatırım yapmayı desteklemelidirler..

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ABSTRACT

In the study, the relationship between high-tech export, agriculture export, and economic growth is analyzed in the context of the export-led growth hypothesis, by using the panel data analysis. In this paper, 20 high-tech exporter countries were selected. These countries are Belgium, Canada, China, Czech Republic, France, Germany, India, Ireland, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Poland, Singapore, Switzerland, Thailand, the UK, and the USA. The data used in the analysis covers the period 2007 to 2018. Panel data analysis method was used in this study. Analysis results show that high technology export increases economic growth more than agricultural export. Policymakers should support to invest in manufacturing of aircraft, helicopters, nuclear reactors, spacecraft, automobile, and its components..

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GENİŞLETİLMİŞ ÖZET

Çalışmada yüksek teknoloji ihracatı, tarım ihracatı ve ekonomik büyüme arasındaki ilişki "İhracata Dayalı Büyüme Hipotezi" bağlamında analiz edilmektedir. İhracata dayalı büyüme hipotezine göre, ihracatın artması ekonomik büyümenin kritik faktörlerinden biridir. Çünkü ihracat ekonomik büyümenin motorudur. Ekonomik büyüme belli bir dönem içinde mal ve hizmet miktarının artmasıdır. Bir ülkenin ekonomik büyümesi ülkenin ihracatı, politik ve toplumsal özellikleri, doğal ve beşeri kaynakları gibi birçok faktöre bağlıdır. İhracat, kaynakların verimsiz alanlardan verimli alanlara aktarılmasını ve ihracatçı sektörlerde verimliliğin artmasını sağlamaktadır. Ayrıca teknolojideki gelişmeler de ihracat için kritik öneme sahiptir. Çünkü yüksek teknoloji ihracatı ülke ekonomisini ciddi boyutta pozitif yönde etkilemektedir. Başlıca yüksek teknoloji sektörleri şunlardır: Askeri mühimmat ve silah imalatı, motor ve türbin imalatı, uçak ve helikopter imalatı, nükleer reaktör ve aksamlarının imalatı, uzay aracı imalatı, otomobil ve otomobil motoru imalatı. Bu makalenin hipotezi: Yüksek teknoloji ürünlerinin ihracatı, ülkelerin ekonomik büyümesini olumlu etkilemektedir. Literatürde aynı konuyu, yöntemi, ülkeleri ve dönemleri içeren başka bir çalışmanın olmaması bu çalışmanın özgünlüğünü göstermektedir. Literatürdeki çalışmalara göre ihracat özellikle de yüksek teknoloji ihracatı ekonomik büyümeyi önemli ölçüde, pozitif yönde etkilemektedir.

Bu çalışmada, yüksek teknoloji ihracatçısı ülkeler (Belçika, Kanada, Çin, Çek Cumhuriyeti, Fransa, Almanya, Hindistan, İrlanda, İtalya, Japonya, Kore, Malezya, Meksika, Hollanda, Polonya, Singapur, İsviçre, Tayland, İngiltere ve ABD) için bir büyüme modeli test edilmiştir. Çalışmada, yüksek teknoloji ihracatı, tarım ihracatı ve ekonomik büyüme arasındaki ilişkiler ampirik olarak belirlenmeye çalışılmıştır. Veriler, 2007-2018 dönemini kapsamaktadır. Çünkü bu ülkeler için veriler 2018'e kadar mevcuttur. Ayrıca GSYİH (Gayri Safi Yurtiçi Hasıla) ve yüksek teknoloji ürünleri ihracatına ilişkin veriler Dünya Bankası'nın "Dünya Kalkınma Göstergeleri" veri tabanından elde edilmiştir. Bununla birlikte Dünya Ticaret Örgütü'nden tarım ürünleri ihracat verileri elde edilmiştir. Toplam ihracat (yüksek teknoloji ve tarım) milyar, ABD Doları cinsinden ölçülmüştür. Tüm gözlemler sabit ve yıllıktır.

Çalışmada yöntem olarak panel veri analizi kullanılmıştır. Çalışmada panel veri analiz yönteminin kullanılmasının nedeni, panel verinin belirli bir dönemde birimlere (ülkeler, şirketler, haneler ve bireyler) ait yatay kesitsel gözlemleri birlikte kullanabilme imkânını vermesidir. Ayrıca panel veri yöntemi, daha belirli model parametrelerini inceleme fırsatı sunarken, yalnızca zaman serileri ya da kesit verileri kullanarak onaylanmayan etkileri doğrulayabilir. Bununla birlikte panel veri yöntemi karmaşık davranışsal modelleri çözmek için de uygundur. Ayrıca panel veriler, zaman serisi gözlemlerine dayanmaktadır. Çalışmada bağımlı değişken GSYİH'dir. Yüksek teknoloji ihracatı ve tarım ihracatı bağımsız değişkenlerdir. Panel veri analizini uygulamadan önce değişkenlerin durağanlığını belirlemek için birim kök testi yapılmıştır. Panel birim kök testleri, araştırmacılar arasında yaygın olarak uygulanmaktadır. Birinci nesil birim kök testleri ilk kez Levin, Lin tarafından kullanılmıştır. Günümüzde Levin, Lin & Chu t, Im, Pesaran ve Shin, Fisher, Breitung, Hadri ve Harris-Tzavalis birim kök testleri kullanılmaktadır. Bu çalışmada Breitung birim kök testi yapılmıştır. Breitung testi dengeli panellerde kullanılır. Breitung'a göre tüm birimler aynı otoregresif katsayılara sahiptir. Birim kök testinden sonra analiz için oluşturulacak modele sabit etkiler modelinin mi, yoksa rassal etkiler modelinin mi uygulanmasının daha doğru olacağını belirlemek amacıyla Hausman testi yapılmıştır. Başka bir ifadeyle Hausman testi, sabit etkiler ve rassal etkiler tahmin edicileri arasından seçim yapmak için kullanılmaktadır. Öncelikle araştırmacılar, modelin doğru ifade edildiği düşüncesi altında, sabit etkiler ve rassal etkiler tahmin edicilerinin kararlı olduğunu ve rassal etkiler tahminci varsayımına göre regresörlerin bireye özgü etkilerle ilişkisi olduğunu kabul etmektedirler. Bu nedenle, rassal etkiler tahmincisi asimptotik olarak faydalıdır. Ayrıca sabit etkiler ve rassal etkiler tahmin edicileri küçük ayrımlara sahiptirler. Bu sebeple, sabit etkiler ve rassal etkiler tahmin edicileri arasında ayrım/seçim yapmak önemlidir. Hausman testi sonrasında heterodastisite, otokorelasyon ve korelasyon testleri uygulanmıştır. Heterodastisite ve korelasyon testlerinin sonuçları pozitif olduğu için robust panel veri testi yapılmıştır. Analiz sonuçları, yüksek teknoloji ihracatının ekonomik büyümeyi tarımsal ihracattan daha fazla artırdığını göstermektedir. Bu doğal bir sonuçtur. Çünkü yüksek teknoloji sağlık, enerji, savunma ve endüstriyel sektörlerde yüksek katma değerli ürünlerle üretim yapılmasını sağlamaktadır. Yüksek teknoloji, üretim faktörlerinden tasarruf etmemizi sağlamaktadır. Diğer bir deyişle, yüksek teknolojiyle daha az girdi ile daha fazla çıktı elde edilmektedir. Bu nedenle ülkeler Ar-Ge faaliyetlerini daha fazla artırmakta ve Ar-Ge çalışmalarına her yıl bütçeden daha fazla pay ayırmaktadırlar. Ayrıca analiz sonuçları "ihracata dayalı büyüme modeli" ile de tutarlıdır.

Ülkeler sürdürülebilir ekonomik büyümeyi sağlamalıdırlar. Çünkü sürdürülebilir ekonomik büyüme, sürdürülebilir ekonomik kalkınma için bir koşuldur. Tüm ülkeler aynı gelişim aşamasına sahip değildir. Ekonomik büyüme seri üretimle artmaktadır. Ülkeler kendilerine yeni pazarlar bularak ihracatlarını artırabilirler. Ticaret engelleri (kotalar ve ticari yasaklar) ihracatı olumsuz etkilemektedir. Bu nedenle dünyadaki ticaret engelleri bir an önce kaldırılmalıdır. Böylece ticaret ve ekonomik büyüme artacaktır. Özellikle, ülkeler yüksek teknoloji ihracatı ile ilgilenmelidir. Yüksek teknoloji ihracatı arttıkça, analizde görüldüğü gibi ekonomik büyüme de artmaktadır. Bu sebeple politika yapıcılar mühimmat ve silah üretimine, uçak ve helikopter imalatına, nükleer reaktör ve bileşenlerinin imalatına, santrifüj üretimine, uzay aracı imalatına, otomobil ve otomobil motoruna yatırım yapmayı desteklemelidirler.

Introduction

Economic growth is an increment in the number of goods and services in a definite period (Hall and Lieberman, 2009, p. 122). The economic growth of a country depends on many factors, such as political and social determinants, technological infrastructure, natural resources, human resources, and export. Export is the producing of goods in a country and conveying them to another country for sale (Schrott, 2014, p. 31). Nowadays, technological progress is one of the most critical elements of economic growth. Also, technological progress enhances the export of high-tech industry of a country. The high-tech industry comprises from these sectors (Frolov and Lebedev, 2007, p. 492): Production of ammunition and arms, production of engines and turbine, manufacturing of aircraft and helicopters, manufacturing of nuclear reactors and its components, production of centrifuges, manufacturing of spacecraft, manufacturing of automobile and engines of the automobile. Export has an important role on economic growth that we explain via "Export-Led Growth Theory". According to the export-led growth hypothesis, the rise of export is one of the critical factors of economic growth. Export is the engine of economic growth (Smith-Medina, 2001, p. 1). International trade promotes the spread of technology and knowledge (Grossman and Helpman, 1991). Export reinforces economic growth in several ways. Specialization occurs if the export of products increases. Thus, the general level of productivity and ability in the export sector rises because of the transposition of the resources from inefficient sector to the productive export sector. The rise in productivity ensures an increase in production (Waithe, Lorde and Francis, 2011, p. 36).

This paper aims to investigate the relationship between high-tech export, agriculture export and economic growth for selected countries [Belgium, Canada, China, Czech Republic, France, Germany, India, Ireland, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Poland, Singapore, Switzerland, Thailand, the UK (the United Kingdom), and the USA (the United States of America)].

The hypothesis of this paper: Exports of high-tech products affect the economic growth of countries positively. This study has a different fundamental idea because there are no studies in the literature that contain the same theme, method, countries, and periods.

Literature Review

There are various studies relevant with this subject in the literature: Berrill (1960) indicates that export could be a problem for the economic growth of small developing countries. Feder (1983) studied the impact of export on economic growth for a group of semi-industrialized less developed countries in the period of 1964-1973. Feder presented that economic growth can increase only if production resources transpose to the productive export sector. Abou-Stait (2005) found that export enhances the level of economic growth in Egypt between 1977 and 2003. Falk (2009) employed a growth model with panel data for 22 OECD countries for the period from 1980 to 2004 by taking 5-year averages. Falk researched the impacts of high-tech export share on economic growth. Falk's study indicated that high-tech share has a positive and significant effect on economic growth. In 2009, Gani applied an empirical analysis for three groups of countries classified as dynamic adopters, potential leaders, and technological leaders. Gani found a positive relationship between economic growth and export for several selected countries. Sun and Heshmati (2010) applied balanced panel data for China's 31 provinces for the period from 2002 to 2007. The findings of the analysis showed that high-tech export has a positive effect on China's economic growth and productivity. Zahonogo (2016) employed a dynamic growth model to

examine the impacts of trade openness on economic growth for sub-Saharan Africa from 1980 to 2012. Zahonogo found that the relationship between trade openness and economic growth is not linear for sub-Saharan Africa. Ustabaş and Ersin (2016) investigated that high-tech export affects economic growth in Turkey positively. Therefore, Turkey should increase investments of R&D and human capital. Alkhateeb, Mahmood and Sultan (2016) examined the hypothesis of export-led growth for Saudi Arabia. Empirical results indicated a long-run relationship between economic growth and export. Uçan, Akyıldız and Maimaitimansuer (2016) determined the impact of export on economic growth for Turkey in the period from 2006 to 2015, using quarterly data. They found unidirectional causality relationship from export to economic growth. Kalaitzi and Cleeve (2018) examined the cointegration analysis between export and economic growth for the United Arab Emirates in the period of 1981-2012. They found that manufactured exports contribute to economic growth in the long-run more than primary exports.

According to the studies in the literature, exports, especially high-tech export affects economic growth positively. Also, according to the export-led growth hypothesis, the rise of export has an important effect on economic growth.

Data Type and Sources

This paper consists of twenty selected countries. The selected countries have the exportation of the most high-tech products, according to the World Bank statistics. These countries are Belgium, Canada, China, Czech Republic, France, Germany, India, Ireland, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Poland, Singapore, Switzerland, Thailand, the UK, and the USA. The data are collected from 2007 to 2018 because of data available for these countries between 2007 to 2018. All observations are constant and annual.

Data on GDP (Gross Domestic Product) and high-tech products export were obtained from the "World Development Indicators" database of the World Bank. Also, agriculture products exportation data were attained from the World Trade Organization. GDP data are in constant 2010 the USA Dollars. Total exports (high-tech and agriculture) are measured in the billion USA Dollars.

Methodology and Model

We used panel data analysis method in this study. In the first step, we applied panel unit roots tests. We tested the stationarity of variables via unit root tests. Panel unit root tests are applied among empirical researchers widely. First-generation unit root tests were used for the first time by Levin, Lin. Nowadays, Levin, Lin & Chu t, Im, Pesaran and Shin, Fisher type, Breitung, Hadri, and Harris-Tzavalis unit root tests are used in common. Andrew Levin and Chien-Fu Lin (1992) worked intimately and developed a model for unit root tests for the model:

$$\Delta y_{i,t} = p y_{i,t-1} + \alpha_0 + \delta_t + \alpha_i + \theta_t + \varepsilon_i,\ t, i = 1,2,..,N,\ t = 1,2,..,T \quad (1)$$

The model contains individual effects and a time trend. Levin and Lin (1993) test indicates that the null H_0 and alternative H_1 as:

$$H_0: p_1=p_2=\ldots=p_N=p=0 \qquad H_1: p_1=p_2=\ldots=p_N=p<0 \quad (2)$$

Levin, Lin, and Chu developed a unit root test. Levin, Lin, Chu test (LLC) proposes these hypotheses as: H_0: each time series contains a unit root. H_1: each time series is stationary. $\sqrt{NT}/T$

$\rightarrow 0$ is the condition for the LLC. NT is the cross-sectional dimension. T is a monotonic function (Kunst, 2011, p. 1). The LLC analysis may be defined as follows (Barbieri, 2006, p. 6):

$$\Delta y_{it} = p y_{it-1} + \alpha_{0i} + \alpha_{1it} + u_{it}, \quad i = 1, 2, \dots, N$$
$$t = 1, 2, ., T \qquad (3)$$

where a time trend (α_{1it}). Also, individual impacts (α_i) are included. u_{it} is presumed to be independently scattered across individuals. Also, the ARMA process is applied for each individual a stationary reversible.

$$u_{it} = \sum_{j=1}^{\infty} \theta_{ij} u_{it-j} + \epsilon_{it} \qquad (4)$$

The So K. Im, M. Hashem Pesaran, and Yongcheol Shin test (1997) open out the hypothesis that $p_1 = p_2 = \dots = p_N$ under H_1. The Im, Pesaran, Shin test is a generalization of the Levin, Lin tests. The model is (Nam T. Hoang and Robert F. McNown, 2006, p. 4):

$y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \epsilon_{i,t}, \quad t = 1, 2, \dots, T \qquad (5)$

The alternative and null hypotheses are identified as:

H_0: $p_i = 1 \qquad i: 1, 2, \dots\dots, N \qquad (6)$

against the alternatives,

H_A: $p_i < 1$, i= 1, 2, .., N_i, $p_i = 1$, $i=N_1+1, N_1 + 2, \dots, N$ (7)

Unit root tests are used for the N cross-section units. The Dickey-Fuller regression:

$y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \epsilon_{i,t} \qquad t = 1, 2, \dots, T \quad (8)$

or Augmented Dickey-Fuller regression (Hoang and McNown, 2006, p. 5):

$$y_{i,t} = p_i y_{i,t-1} + \sum_{j=1}^{p_i} \theta_{ij} \Delta y_{i,t-1} + \epsilon_{i,t} \qquad t = 1,2,..T \qquad (9)$$

is forecasted. The t-statistic for testing $p_i = 1$ is calculated. $t_{i,T}$(i= 1, 2, … , N) symbolize t- statistic for testing unit roots in individual series i, $V(t_{i,T})=\sigma^2$ and $E(t_{i,T}) = \mu$. Besides,

$$\bar{t}_{N,T} = \frac{1}{N} \sum_{i=1}^{N} t_{i,T} \ and \ \sqrt{N} \ \frac{(\bar{t}_{N,T} - \mu)}{\sigma} \overset{N}{\Rightarrow} N(0,1) \qquad (10)$$

The Im, Pesaran, Shin test combines results that are obtained via N unit roots tests. N unit roots tests are attained from N cross-section units. The Im, Pesaran, Shin test suggests using the ADF t-test for individual series. The Im, Pesaran, Shin test (IPS) proposes to use the LR bar test that is attributed to likelihood ratio statistics. G.S. Maddala and Shaowen Wu (1999, p. 636) advise using Fisher unit root tests for three reasons. First, these tests can use for any unit root test related to a single time-series. Second, Fisher tests can differ related to T on cross-sections, just because these tests do not need a balanced panel as the IPS test does. Third, these tests can use for different lag lengths related to the individual ADF regression. The Breitung test is used in balanced panels. All units have the same autoregressive coefficients (Breitung and Samarjit,

2005). The Hadri unit root test is different from other unit root tests because zero and alternative hypotheses are replaced. Z statistic is applied in the Hadri test (Hadri, 2000).

In the second step, we implemented the Hausman test. Hausman test is used to choose among fixed effects and random effects estimators. Primarily, researchers know that fixed effects and random effects estimators are stable under the idea that the model is stated accurately, and the regressors have a relationship with the individual-specific effects according to the random effects estimator supposition. In the circumstances, the random effects estimator is asymptotically useful; for this reason, the fixed effects and the random effects estimators have small separations. Therefore, the distinction is important among the fixed effects and the random effects estimators (Hausman,1978). In the third step, we applied heteroscedasticity, autocorrelation, and correlation tests. Results of heteroscedasticity and correlation tests are positive. Therefore, we performed a robust panel data test in the fourth step. Panel data are gathered together with horizontal cross-sectional observations belonging to units (countries, companies, households, and individuals) at a certain period (Greene, 2012, pp. 383-384).

Panel data is based on time-series observations. There are two dimensions, which are time series, and section dimensions. Besides, panel data has complicated and hierarchical structures (Hsiao, 2006, p. 1). It is possible to explain the causes as follows (Hsiao, 2006, pp. 3-6):

1. The method of panel data fits to tackle complex behavioral models.

2. The problems related to the regression results can be solved if the panel data model is structured appropriately.

3. The panel data method is suitable for controlling the dynamics of adjustment.

4. The panel data method provides an opportunity to examine more certain model parameters.

5. The method of panel data can confirm influences that are not confirmed simply by carrying out pure time-series and pure cross-section data.

The panel data model is written as follows (Hsiao, 2003):

$$Y_{it} = \alpha_{it} + \beta_{kit} X_{kit} + u_{it} \qquad i = 1,\ldots..,N;\ t=1,\ldots,T \qquad (11)$$

where; Y is the dependent variable, X_k is the independent variable, α is fixed-parameter, β is slope parameter, and u is an error term, and i represents units (individuals, households, firms, countries). T symbolizes time as day, month, and year (Hsiao, 2003). Concerning the panel data model of countries' high-tech exports, we consider the following model:

$$fg_{it} = \beta_{0i} + \beta_{1i} fh_{it} + \beta_{2i} fa_{it} + \varepsilon_{it} + u_{it} \qquad (12)$$

where; fg_{it}: GDP, fh_{it}: high-tech export, fa_{it}: agriculture export, f: the first difference.

Empirical Results

In this study, we used a panel data method, which covers the period of 2007-2018. The study concerns both high-tech and agriculture exports. GDP is the dependent variable in the model. The high-tech export of countries and agriculture export of countries are independent variables. The purpose of the analysis is to determine the impacts of high-tech export and agriculture export on GDP.

Table 1: Panel unit root test results

Variables	Statistics	IPS	Breitung
logg	Statistic	-1.2085	0.9201
	p-value	0.1134	0.8212
fg	Statistic	-5.8370**	-5.4071**
	p-value	0.0000	0.0000
logh	Statistic	-2.4008**	-0.1459
	p-value	0.0080	0.4420
fh	Statistic	-6.4435**	-5.4998**
	p-value	0.0000	0.0000
loga	Statistic	-3.3734**	-0.4317
	p-value	0.0004	0.3330
fa	Statistic	-5.1874**	-3.2987**
	p-value	0.0000	0.0005
f : First Difference		** :Statistically significant at 5% level.	
log: Logaritmic		IPS: Im-Pesaran-Shin Unit Root Test	

Source: Own calculations, using Stata.

The IPS, and Breitung panel unit root tests are applied to determine the stability of the variables. Also, logg, logh, and loga are not stable for all unit root tests. Therefore, we employed the first difference of logg, logh, loga and obtained fg, fh, and fa. Therefore, fg, fh, and fa have become stable values (Table 1).

Table 2: Hausman test result

Dependent Variable	fg
Prob>chi2	0.9490
Result	Random

Source: Own calculations, using stata.

Hausman test's prob>chi2 value is 0.9490. In other words, 0.9490>0,05. Therefore, H_0 (the random effect is dominant) hypothesis is accepted, and the random-effects model is preferred (Table 2). We applied heteroscedasticity, autocorrelation, and correlation tests. Also, results heteroscedasticity and correlation tests are positive, autocorrelation test is negative. Therefore, we performed a robust panel data test.

Table 3: Panel data analysis results

fg	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
fh	.065067 **	.0041	15.53	0,000	.0568526 .073281
fa	.0403689 **	.0058	6.87	0,000	.0288456 .051892

cons	.0223381	.0008	25.92	0,000	.0206489	.024027
Random-effects GLS regression				Prob>chi2	0,000	

** : Statistically significant at 5% level.

Source: Own calculations, using stata.

The independent variable fh affects the dependent variable fg positively as expected. If fh increases by 1 unit, fg increases by 0,06 unit. Also, the fa variable affects the dependent variable fg positively. If fa increases 1 unit, fg increases 0,04 unit (Table 3). Analysis results show that high technology export increases economic growth more than agricultural export. This is a natural result because high-tech provides to produce with high value-added products in the health, energy, defence and industrial sectors. The high-tech allows us to save money from production factors. In other words, we can have more output with less input via high-tech. Therefore, countries are increased R&D activities more and allocated from the budget more share every year. These results are consistent with "the export-led growth model".

Conclusion

The relationship between export and economic growth is one of the most important topics of discussion in recent decades. In this study, a growth model for high-tech exporter countries [Belgium, Canada, China, Czech Republic, France, Germany, India, Ireland, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, Poland, Singapore, Switzerland, Thailand, the UK (the United Kingdom), and the USA (the United States of America)] are tested. In this paper, we tried to determine the relationships among high-tech export, agriculture export, and economic growth empirically. The data are collected between the period 2007 to 2018 because the data for these countries are available until 2018. GDP is the dependent variable. High-tech export and agriculture export are independent variables.

The results of the analysis indicate that high-tech products exportation has an important role on economic growth because high-tech products export increases economic growth. Countries should provide sustainable economic growth because sustainable economic growth is a condition for sustainable economic development. All countries have not the same developmental stage. The economic growth has increased with mass production. The export of countries has risen when they found new markets. The trade barriers (quotas and commercial prohibitions) affect export negatively. Therefore, trade barriers should be lifted in the world as soon as possible. Thus, trade and economic growth will increase. Notably, countries should care for high-tech export. As high-tech export increases, economic growth also increases, as seen in the analysis. Also, the economic growth rates of high-tech exporter countries are corresponded according to the results of the analysis in this study. Policymakers should support to invest the production of ammunition and arms, manufacturing of aircraft and helicopters, manufacturing of nuclear reactors and its components, production of centrifuges, manufacturing of spacecraft, manufacturing of automobiles and engine of an automobile.

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