YÖNETİM BİLİŞİM SİSTEMLERİ DERGİSİ
http://dergipark.ulakbim.gov.tr/ybs/

Yayın Geliş Tarihi: 30.05.2016
Yayına Kabul Tarihi: 15.08.2016
Online Yayın Tarihi: 05.10.2016

Cilt:1, Sayı:3, Yıl:2016, Sayfa 317-324
ISSN: 2148-3752

SUSTAINABILITY OF HIGH TECHNOLOGY EXPORT: EVIDENCE FROM EUROPEAN COUNTRIES

Tuğba Koç

Mustafa Koç

Fatih Burak Gümüş

Abstract

Today, utilizing from technology is not sufficient for economic development and prosperity of a country. Producing and also marketing the new technology are also crucial. For this reason, volume of high technology export which is required intensive research and development expenditures and activities is accepted as economic development indicator in recent years. It can be said that the country which has sustainable high technology volume has also consistent economic development. Aim of this study is to examine 17 European countries' sustainability of high technology export. In order to contribute to the literature, SurADF panel unit root test is used. Results show that only Denmark, Lithuanian and Slovenia have the sustainable high technology export. For further research different econometric analysis and countries can be used.

Keywords: High technology export, panel unit root, sustainability

YÜKSEK TEKNOLOJİLİ ÜRÜN İHRACATININ SÜRDÜRÜLEBİLİRLİĞİ: AVRUPA ÜLKELERİ ÖRNEĞİ

Özet

Günümüzde ülkelerin ekonomik kalkınma ve refah düzeyi artışı için teknolojiden faydalanıyor olmaları yeterli olmamakta, aynı zamanda yeni teknoloji üretmeleri ve ürettiği teknolojiyi pazarlıyor olabilmeleri gerekmektedir. Bu sebeple yoğun Ar-Ge çalışması ve harcaması gerektiren yüksek teknolojili ürün ihracatı hacimleri ülkeler için son yıllarda ekonomik gelişmişliğin bir göstergesi olarak kabul edilmektedir. Sürdürülebilir yüksek teknolojili ürün ihracatı hacmine sahip olan bir ülkenin istikrarlı bir kalkınma politikasının olduğu söylenebilir. Bu çalışmada amaç seçilen 17 Avrupa ülkesindeki yüksek teknolojili ürün ihracatının sürdürülebilir olup olmadığının test edilmesidir. Bunun için SurADF panel birim kök testi kullanılmıştır ve literatüre bu yeni metodolojik yaklaşımla katkı sağlanmıştır. Çıkan sonuçlara göre sadece Danimarka, Litvanya ve Slovenya'da sürdürülebilirlik gözlemlenmiştir.Sonraki çalışmalarda farklı ekonometrik yöntemler ve değişik ülke kategorileri kullanılarak uygulama kısmı genişletilebilir.

Anahtar Kelimeler: Yüksek teknolojili ürün ihracatı, panel birim kök, sürdürülebilirlik

1. INTRODUCTION AND LITERATURE REVIEW

Today's emerging criteria in development of a country is wealth in international trade. Not only trade volume of a country is important, but also the assets which have been traded are also vital. Another point is highly developed countries have higher technological development. Here comes the most critical part, the high technology exports are worth to be investigated in order to foresee countries situations. In literature it is supported that high technology capabilities of a nation is a key component of economic development (Connolly, 2012), however there is lack in the literature on sustainability of high technology exports. Therefore the literature on high technology exports, R&D-in the context of high technology exports and economic perspective have examined together.

Samimi and Leadary (2010) have investigated the thirty countries in the period 2001-2006 and they have indicated that high technology exports can be measured by the R&D expenditure in countries and relationship between R&D expenditure and economic growth is analyzed by cointegration method.

Zhang et al. (2012) have used VAR model to examine the scientific innovation and observed that scientific innovation may have positive effect on country's economy.

Amaghouss and Ibourk (2013) have studies OECD countries in the context of entrepreneurship, innovation and economic growth. They examined OECD countries in the period of 1990-2010 and they have concluded that these variables have positive effects on economic growth.

Connolly (2012) has stated in his study that sophistication of high technology exports has a considerable positive progress in emerging Europe and low-to middle- income countries.

Göçer (2013) has researched the relation between R&D expenditure and high technology & information-communication technology (ICT) exports.

Kılıç et al.(2014) have examined G8 countries via panel causality tests and they have also stated in their study that R&D expenditure has positive effect on high technology exports.

SurADF panel unit root test has being used by many researchers in order to investigate sustainability, effectiveness and effect of external shocks in established models. For instance, Tzeng and Chen (2015) used SurADF panel unit root test to determine the stationary levels of variables in their study. Similarly, Gümüş and Koç (2015) used same panel unit root test to check the prerequisites of panel causality test. Yu (2016) used similar methodology to investigate the external effects on their variables.

These examples can be extendable by many studies in almost every field. SurADF panel unit test distinguishes from other traditional panel unit root test by its specific feature that SurADF panel unit test determines stationary levels of each variable in the panel as well as stationary level of the panel.

2. METHODOLOGY AND EMPIRICAL FINDINGS

In this study, high technology exports are analyzed for European countries. 17 countries form European region is selected accordance to availability of data. Data is obtained from World Bank database. In order to investigate sustainability, unit root test has to be conducted. First, cross sectional dependence will be investigated. Then, according to cross sectional dependence test results, unit root test for cross sectionally dependent series will be used.

2.1.Methodological Background

2.1.1. Cross-sectional dependence (CD-Test)

The test statistics of this test is developed by Pesaran (2004) and is as following:

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

The null hypothesis of this test is non-existence of cross-sectional dependence. Furthermore, the limit of $CD \rightarrow N(0,1)$ function is valid if $N \rightarrow \infty$ *and* T is sufficiently great. Unlike LM statistics, the average of CD statistics is zero for panel data models including heterogeneous, non-stationary and dynamic models when T and N are fixed values (De Hoyos & Sarafidis, 2006).

2.1.2. SurADF panel unit root test

SurADF (2001) panel unit root test is preferred because this test can show the stationarity of each variable in the panel if there exists unit root in the panel. SurADF (Seemingly Unrelated Regressions Augmented Dickey-Fuller) developed by Breuer, McNown and Wallace (2001) is actually augmented Dickey-Fuller test based on Seemingly Unrelated Regressions (SUR) panel prediction model. These ADF equations are shown below:

$$\begin{aligned}
\Delta y_{1,t} &= \alpha_1 + (\rho_1 - 1) y_{1,t-1} + \sum\nolimits_{i=1} \delta_i \Delta y_{1,t-i} + u_{1,t} \\
\Delta y_{2,t} &= \alpha_2 + (\rho_2 - 1) y_{2,t-1} + \sum\nolimits_{i=1} \delta_i \Delta y_{2,t-i} + u_{2,t} \\
&\vdots \\
\Delta y_{N,t} &= \alpha_N + (\rho_N - 1) y_{N,t-1} + \sum\nolimits_{i=1} \delta_i \Delta y_{N,t-i} + u_{N,t},
\end{aligned}$$

Here, N represents total country number. In this method, there exist null and alternative hypotheses in N number:

$$H_0: \beta_i = 0$$

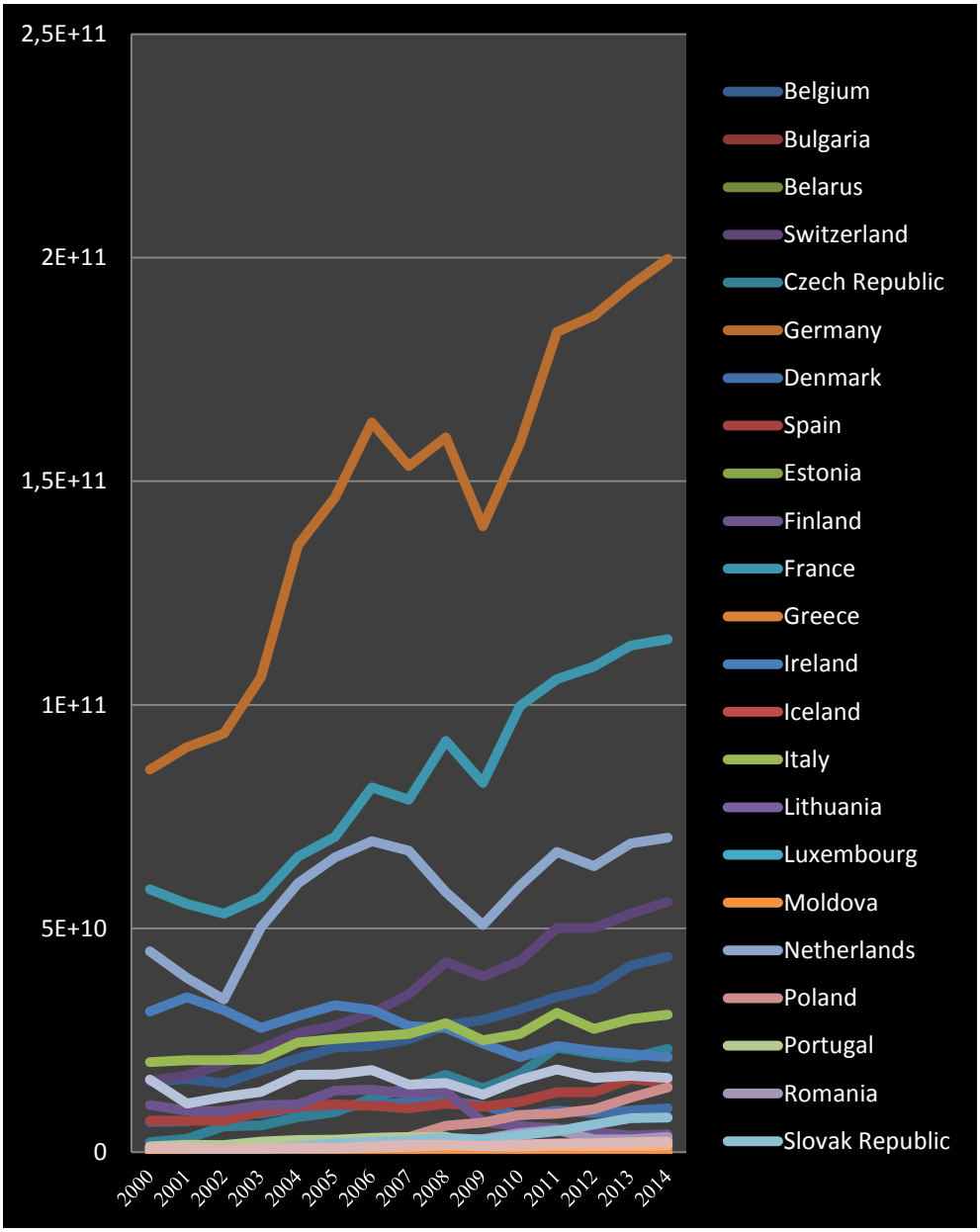
$$H_A: \beta_i < 0 \qquad i=(1,2,3,...,N)$$

If test statistics obtained from SurADF is greater than critical value, the null hypothesis is rejected and series is assumed stationary. SurADF critical values are bootstrap critical values gained via 10,000 repetitive Monte Carlo Simulation (Doğru, 2013).

2.2. Empirical Findings

High technology exports data of 17 European countries can be seen in Figure 1. Clearly, Germany has the highest high technology exports than any other countries. France and Netherlands are following Germany. It can be easily interpreted that high export may follow high development according to a country.

Figure 1. High Technology Exports of 17 Countries



2.2.1. CD test results

Before going through unit root test, cross sectional dependence must be analyzed. With the existence of cross sectional dependence, unit root tests taking into account this dependence are required to be used.

Table 1. CD-Test Results

	High Technology Exports
cd Lm1 *	190.462 [0.001]
cd Lm2 **	3.302 [0.000]
cd Lm ***	-1.361 [0.087]

Note: The values in the table are representing CD-test results, the values in the brackets are showing probability *(Breusch and Pagan, 1980), **(Pesaran-CDlm, 2004), ***(Pesaran-CD, 2004) .

The existence of cross-sectional dependence is analyzed by:

- Breusch Pagan (1980) cd LM1 test if 'time' dimension is greater than 'cross-section' dimension (T>N),
- Pesaran (2004) cd LM2 test if 'time' dimension is equal or close to 'cross-section' dimension (T=N),
- Pesaran (2004) cd LM test if 'time' dimension is much smaller than 'cross-section' dimension (T<N).

The 'time' dimension (T) of our data is 15 (2000 to 2014) and 'cross-section' dimension (N) is 17 (17 European countries). Therefore cd Lm test statistics must be taken into account. According to cd Lm test results, cross-sectional dependence exists for financial development. Therefore, unit root test for cross-sectional dependent panel data will be used.

2.2.2. Panel unit root test results

Traditional unit root tests are applied under the assumption of non-existence of cross-sectional dependence. Therefore, second generation unit root tests must be used for cross sectional dependent series. SurADF (2001) unit root test is applied for our data due to fact that this test is showing each variable with unit root if there exists unit root in the panel.

According to SurADF unit root test results, Denmark, Lithuania and Slovenia have a unit root. Other 14 countries are stationary at level. This means high technology exports in Denmark, Lithuania and Slovenia are sustainable, according to our findings.

Table 2. SurADF test results

	High Technology Exports	
	t-statistics	Critical value (%5)
Belgium	-8.9427	-6.9248
Bulgaria	-7.8013	-5.8786
Belarus	-8.1698	-8.0627
Switzerland	-8.2251	-5.6682
Czech Republic	-6.2908	-5.5121
Germany	-6.4707	-6.3522
Denmark	**-6.9333***	-7.6350
Spain	-7.4034	-7.2411
Estonia	-8.5149	-5.7670
Finland	-7.7019	-5.8946
France	-7.1386	-6.8459
Greece	-6.4864	-6.2510
Ireland	-6.5670	-6.5243
Iceland	-7.5590	-5.7920
Italy	-8.5647	-8.2249
Lithuania	**-6.9565***	-8.2727
Luxembourg	-6.7567	-5.9900
Moldova	-8.9427	-6.9248
Netherlands	-7.8013	-5.8786
Poland	-8.1698	-8.0627
Portugal	-8.2251	-5.6682
Romania	-6.2908	-5.5121
Slovak Republic	-6.4707	-6.3522
Slovenia	**-6.9333***	-7.6350
Sweden	-7.4034	-7.2411
Turkey	-8.5149	-5.7670

Note: * indicates the country with the unit root

3. Conclusion

In this study, the sustainability of high technology export is examined for 17 European countries. There are two remarkable results that have been found in this study. One, there are 3 European countries with sustainable high technology export. Second, Turkey is not one of these three countries.

If an investor wants to invest on high technology, than he or she probably should invest in Denmark, Lithuania and Slovenia. Moreover, if there exist policies or governmental issues dependent on high technology exports, than these policies and issues are also concluded as sustainable.

For further studies, one can add new variable to high technology export variable in order to visualize the attitudes of this variable better. Also other unit root test that is considering structural breaks can be also used in order to investigate the sustainability of high technology exports.

References

Amaghouss, J., & Ibourk, A. (2013). Entrepreneurial Activities, Innovation and Economic Growth: The Role of Cyclical Factors Evidence from OECD Countries for the Period 2001-2009. *International Business Research, 6*(1), 153-165.

Breuer, J., McNown, R., & Wallace, M. (2001). The Review Misleading Inferences from Panel Unit-Root Tests with and Illustration from Puchasing Power Parity. *Review of Inetrnational Economics, 9*(3), 482-493.

Breusch, T., & Pagan, A. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *The Review of Economic Studies, 47*(1), 239-253.

Connolly, R. (2012). Climbing the Ladder? High-Technology Export Performance in Emerging Europe. *Eurasian Geography and Economics, 53*(3), 356-379.

De Hoyos, R. E., & Sarafidis, V. (2006). Testing for cross-sectional dependence in panel-data models. *Stata Journal, 6*(4), 482.

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

GÜMÜŞ, F. B., & KOÇ, M. (2015). ÜLKELERİN FİNANSAL GELİŞMİŞLİKLERİ İLE ENERJİ TÜKETİMLERİ ARASINDAKİ İLİŞKİ: DÖRT KITA ÖRNEĞİ. *Suleyman Demirel University Journal of Faculty of Economics & Administrative Sciences, 20*(2), 151-164.

Kılıç, C., Bayar, Y., & Zekioğlu, H. (2014). ARAŞTIRMA GELİŞTİRME HARCAMALARININ YÜKSEK TEKNOLOJİ ÜRÜN İHRACATI ÜZERİNDEKİ ETKİSİ: G–8 ÜLKELERİ İÇİN BİR PANEL VERİ ANALİZİ. *Erciyes Üniversitesi İİBF Dergisi*(44), 115-130.

Peseran, M. (2004). General Diagnostic Tests for Corss Section Dependence in Panels. *IZA Discussion Paper*, 1240.

Samimi, J., & Ledary, R. (2010). ICT and Economic Growth: New Evidence from Some Developing Countries. *Australian Journal of Basic and Applied Sciences, 4*(8), 3086-3091.

Tzeng, H.-W., & Chen, T.-H. (2015). An Empirical Testing Hysteresis in Unemployment for Eight Eastern Europe Countries: A Panel SURADF Approach. *Fertility Dakota University Journal*(40), 87-102.

YU, C.-P. (2016). Size and Growth of Mobile Phone Firms in Mainland China, Hong Kong, and Taiwan. *The Chinese Economy, 49*(4), 277-286.

Zhang, L., Song, W., & He, J. (2012). Empirical Research on the Relationship between Scientific Innovation and Economic Growth in Beijing. *Technology and Investment, 3*, 168-173.