Çankırı Karatekin Üniversitesi
İktisadi ve İdari Bilimler
Fakültesi Dergisi
Y. 2024, Cilt 14, Sayı 1, ss. 160-175

Cankırı Karatekin University
Journal of the Faculty of Economics
and Administrative Sciences
Y. 2024, Volume 14, Issue 1, pp. 160-175

Araştırma Makalesi

Real Effective Exchange Rate and Export Sophistication: A Dynamic Panel Data Analysis

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Abstract

In recent years, a new strand of the literature has argued that not the quantity, but the quality of exports is at the core of growth and development. One of the most important tools that could affect exports and their quality is the real effective exchange rate. However, connections between the quality of exports and the real effective exchange rate have not been fully explored. Based on a data from 57 countries for the years between 2005 and 2015, this paper investigates the relationship between export sophistication and real effective exchange rate. Using a novel database of export sophistication and utilizing a dynamic panel data methodology, this paper shows that an appreciation in the real effective exchange rate improves the sophistication of exports. In addition, the results also show that the initial income of countries, foreign direct investment, human capital, and domestic savings positively affect export sophistication.

Keywords: Export sophistication, real effective exchange rate, dynamic panel data
JEL Classification Codes: F10, F14, O24

Reel Efektif Döviz Kuru ve Sofistike Ürün İhracatı: Dinamik Panel Veri Analizi

Öz

Son yıllarda literatürde yeni bir akım, büyüme ve kalkınmanın temelinde ihracatın miktarından ziyade kalitesinin olduğunu vurgulamaktadır. İhracatı ve kalitesini etkileyebilecek en önemli araçlardan biri reel efektif döviz kurudur. Ancak ihracatın kalitesi ile reel döviz kuru arasındaki bağlantılar yeterince analiz edilmemiştir. Bu makale, 2005 ile 2015 yılları arasında 57 ülke için, sofistike ürün ihracatı ile reel efektif döviz kuru arasındaki ilişkiyi araştırmaktadır. Sofistike ürün ihracatına ilişkin yeni bir veri tabanı ve dinamik panel veri metodolojisi kullanan bu çalışma, reel döviz kurundaki değerlenmenin ihracatın niteliğini arttırdığını göstermektedir. Ayrıca sonuçlar, başlangıç gelirlerinin, doğrudan yabancı yatırımların, beşeri sermayenin ve tasarrufların sofistike ürün ihracatını olumlu etkilediğini göstermektedir.

Anahtar kelimeler: Sofistike ürün ihracatı, reel efektif döviz kuru, dinamik panel veri
Jel Sınıflandırma Kodları: F10, F14, O24

Geliş Tarihi (Received): 24.11.2023 – Kabul Edilme Tarihi (Accepted): 23.02.2024
Atıfta bulunmak için / Cite this paper:
Güneri, B. (2024). Real effective exchange rate and export sophistication: a dynamic panel data analysis. *Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 14* (1), 160-175 doi: 10.18074/ckuiibfd.1395437

1. Introduction

Increasing exports to accelerate the growth performance of a country has long been an important part of the growth and development literature. Known as the export-led growth, many countries around the world followed this strategy to gain from globalization by opening themselves to international trade. Historically, countries that followed an export-led growth strategy, such as the four Asian Tigers in the 1970s and 1980s and China in the 2000s, maintained an undervalued exchange rate. The main argument behind maintaining an undervalued exchange rate is that a decrease in real exchange rates lowers the relative price of local goods and increases exports because low domestic prices create an incentive for foreign firms to switch their spending. In addition, an undervalued real exchange lowers labor costs due to weaker domestic currency (Blecker, 1989) and increases the profitability of local firms by making domestic goods cheaper (Nucci and Pozzolo, 2001). Therefore, depreciation in domestic currency increases the competitiveness of exports of a country and contributes to the growth performance of an economy by allowing countries to export a higher volume of goods.

In recent years, a new strand of the literature argued that not the quantity, but the quality of exports is at the core of growth and development (Hausmann, Hwang and Rodrik, 2007; Hidalgo and Hausmann, 2009). This strand of the literature suggests that countries exporting goods that richer countries export and have higher productivity contributes significantly to economic performance and growth. To further investigate this phenomenon, Hausmann et al. (2007) created an index called EXPY, which measures the sophistication of exports in a country by controlling for the income level of countries. Afterwards, Hausmann et al. (2007) also empirically showed that countries with higher EXPY experience higher rates of growth. The idea of exporting a sophisticated basket of goods and the rationale behind the EXPY rapidly gained attention and several studies proved that there exists a positive link between export sophistication and growth (Jarreau and Poncet, 2012; Lin Weldemicael, and Wang, 2017; Poncet and Starosta de Waldemar, 2013). Furthermore, it is proved that export sophistication lowers income inequality (Hartmann, Guevara, Jara-Figueroa, Aristarán, and Hidalgo, 2017), helps countries to escape from middle income trap (Fortunato and Razo 2014), and improves the total factor energy efficiency (Liu, Xue, Mao, Irfan, and Wu, 2023). Therefore, strategies aiming at producing high tech goods and exporting them is at least as important as increasing the volume of exports. One of the striking results of the studies between real exchange rate and high technology exports is that high tech exports do not get affected by a devaluation in exchange rate. For example, according to the International Monetary Fund (2013), if a country's exports are mainly technologically advanced luxury brands and does not face a severe price competition, real exchange rate devaluation may not have a significant impact on exports. Similarly, Demir and Razmi (2022) showed that exports that require high skills and technology do not get affected by a depreciation in real exchange rate.

Therefore, it is crucial to analyze the link between export sophistication and real effective exchange rate. As mentioned earlier, it is widely accepted in the literature that a lower exchange rate increases total exports, however, the mechanisms between export sophistication and real exchange rate have not been addressed adequately and the studies examining the link between these two variables are relatively scarce.

Theoretically, real exchange rates could affect the sophistication of exports via various channels. Firstly, an increase in the real exchange rate implies a more powerful currency and thus allows firms to buy and invest in new and advanced technologies, as well as boosting research and development activities (Gan and Cheng, 2020). Moreover, an overvaluation of the real exchange rate decreases the cost of imported inputs and creates a more competitive environment for the traded goods sector (Demir and Razmi, 2022). In addition, an overvaluation in the exchange rate allows countries to produce goods with higher productivity, which are more technology-intensive, and as a result, boosts export sophistication and growth (Cimoli, Fleitas, and Porcile, 2013). Similarly, an appreciation in domestic currency enables firms to reach higher quality inputs from international markets and thus yields a rise in exported product quality (Hu, Parsley, and Tan, 2017). Last but not least, Eichengreen (2011) argued that an undervalued exchange rate makes it difficult to allocate resources through more technologically complex activities, therefore causing countries to get stuck with low productive and labor-intensive exports.

To our knowledge, only a few studies exist in the literature that empirically analyzes the relationship between the real exchange rate and export sophistication. Among these, Gan and Cheng (2020) examined this relationship from a micro perspective and showed that appreciation of the Renminbi in China between the years 2000 and 2010 significantly increased the export sophistication of Chinese firms. Correspondingly, Hu et al. (2017) took a micro perspective and showed that export quality in a country increases as the exchange rate appreciates. Cimoli et al. (2013), on the other hand, analyzed this relationship from a macro perspective and found that an increase in the real exchange rate causes a rise in export shares of high-tech products. Similarly, Gaur, Kant, and Verma (2020) also showed that an increase in real effective exchange rate yields an increase in high-tech exports for a sample of 15 countries.

The purpose of this paper is to examine the relationship between export sophistication and the real effective exchange rate. For this purpose, we collect data for a group of countries for the years between 2005 and 2015 and then empirically analyze the connections between the real exchange rate and export sophistication. This paper contributes to the literature in several ways. First of all, this paper is one of the few in the literature that analyzes the relationship between the real effective exchange rate and export sophistication. Secondly, this paper uses a novel export

sophistication data from Abdmoulah (2023), which uses a relatively new Trade in Value-Added (TiVA) database. This database of Abdmoulah (2023) covers a total of 35 sectors, of which 14 of them are services. Including 14 different sectors of services is one of the most significant contributions of this dataset since most of the previous datasets and thus empirical papers relatively neglected the importance of services in export sophistication. According to World Development Indicators (2023), the value of total exports of services is a little more than 7 trillion dollars, whereas the total value of exports of goods is around 24 trillion dollars. This suggests that approximately 25% of total trade around the world belongs to services, and neglecting their role might yield biased results. Thirdly, this paper considers the dynamic nature of the relationship by using a system GMM approach, which allows capturing the persistence of export sophistication as well as controlling for potential methodological problems such as endogeneity and serial correlation.

The remaining part of the paper is as follows: Chapter 2 briefly explains the data and discusses the methodology, and Chapter 3 presents the estimation results. Finally, Chapter 4 concludes and discusses policy implications.

2. Methodology and Data

The empirical methodology includes a panel of 57 countries for the years between 2005 and 2015. The dependent variable, namely export sophistication, is taken from Abdmoulah (2023), since using this dataset provides several advantages. First of all, the data set uses the Trade in Value Added (Tiva) database, and the Tiva database takes into account the value added by each country in the production of goods and services, rather than the gross trade of goods and services. Secondly, this database allows to isolate double counting in global trade by accounting for the increasing divide between domestic productive structure and countries' foreign trade, as an increasing share of gross exports rely on imported goods and services. Last but not least, the Tiva database is one of the best that considers the role of services in export sophistication since it includes a broad sector of services. The empirical model used in this paper can be specified as follows:

$$\log (EXPY)_{it} = \beta_1 \log (EXPY)_{i,t-1} + \beta_2 REER_{it} + \beta_3 X_{it} + \varepsilon_{it} \quad (1)$$

In the equation above, log (EXPY) represents the logarithm of the export sophistication index, REER represents the real effective exchange rate, X is a vector of control variables, and ε is the error term. Control variables are selected based on the previous literature of the determinants of export sophistication. Clearly, the easiest way to estimate the above equation is using simple OLS or fixed effects methodology; however, these methods might cause some problems. First and foremost, while estimating the equation above, the dynamic nature should be taken into account since past values of export sophistication could have an impact on current values of export sophistication. Thus, there might be a serial correlation problem due to the dynamic nature of export sophistication if the equation is

estimated by OLS or fixed effects. In addition, endogeneity bias might arise because a bi-directional relationship could exist between export sophistication and some control variables. These methodological problems can be solved by using a dynamic panel data estimator, namely generalized method of moments (GMM) estimator proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998), since the GMM estimator uses lags of dependent variables as instruments to solve the endogeneity problem, and also makes the regressors time invariant by using lagged levels of the dependent variable as well as using regressors to remove country-fixed specific effects. This paper benefits from Kripfganz's (2019) version of dynamic panel data methodology due to its several advantages. First of all, it is possible in Kripfganz's (2019) version to combine linear and nonlinear moment conditions proposed by Ahn and Schmidt (1995), which allows substantial efficiency gains and increases finite sample performance. In addition, because of the non-linear moment conditions, this version allows solving a possible weak instrument problem that could appear in Arellano and Bond (1991) difference GMM estimator. Furthermore, this estimator is robust to deviations from mean stationary, which might be problematic in Blundell and Bond (1998) system GMM approach (Kripfganz, 2019). Moreover, this version of GMM has a global collapse option, which naturally solves the "too many instruments" problem. This problem refers to the idea that when the number of instruments is greater than the number of groups in a GMM setting, it might create biased estimates (Roodman, 2007). Introducing the collapse option automatically solves this problem.

The data for the real effective exchange rate is taken from Darvas (2021), which is one of the most comprehensive data sets among the real effective exchange rate databases. Other data sets such as the IMF, World Bank, OECD, and Bank for International Settlements, also publish real effective exchange rate data, but their coverage is not sufficient, and also these databases include fewer countries relative to Darvas (2021). Furthermore, Darvas (2021) database calculates exchange rate indices from a broader perspective (170 trading partners) as well as a narrower perspective (65 trading partners), which allows to check for the robustness of estimations using two different indices.

The first control variable used in the model is the logarithm of Gross Domestic Product (GDP) per capita in 2005, i.e. initial GDP, and is taken from Abdmoulah (2023). Pioneers of the export sophistication index, namely Hausmann et al. (2007) showed that GDP per capita and the size of the economy are important determinants of export sophistication. Furthermore, it is well known in the literature that countries with low-income levels usually export simple products such as minerals or agriculture (Fortunato and Razo, 2014), whereas high income countries usually export complex and technologically intensive products, such as electronics and chemicals. Therefore, initial GDP of countries is expected to have a positive impact on export sophistication.

Another explanatory variable that has been used in the model is the rate of foreign direct investment inflows (FDI) to the GDP and taken from the World Bank World Development Indicators. According to Weldemicael (2012), FDI could affect export sophistication in two ways. The first one is the direct effect, which argues that domestic firms that collaborate with international firms are more prone to export sophisticated products to the global market. The second one is the indirect effect, which suggests that the existence of multinational companies and their investments in firms can increase productivity and innovation through spillover effects. Therefore, FDI is expected to have a positive effect on export sophistication.

The fourth explanatory variable is human capital, and it is proxied by primary school enrollment data taken from the World Bank. It is known that the production of sophisticated products requires better education as well as high skills, and human capital is crucial for population in gaining various skills and getting more education. Mincer (1984) argued that human capital is technically a factor of production, and a rise in education, training, and skills of individuals increases the level of productivity. Besides, Hausmann et al. (2007) showed that an increase in productivity results in an improvement in the sophistication of production. Moreover, Tebaldi (2011) stated that sophisticated exports are not capital intensive but human capital intensive, which suggests that export sophistication is directly linked to human capital. Thus, a positive relationship is expected between human capital and export sophistication.

Population growth is another variable included in the empirical model. There exist two opposite effects of population growth on export sophistication according to the theoretical literature: The first one argues that population growth harms the sophistication of production since a higher population means individuals have fewer productive factors per capita, thus productivity decreases. On the other hand, the second effect suggests that growth in population could increase productivity through innovation via specialization or creating greater economies of scale (Pritchett, 1996). Therefore, the relationship between export sophistication and the growth of the population seems ambiguous.

The last variable used in the empirical model is the domestic savings rate. A rise in the domestic savings rate results in lower interest rates, which boost investment opportunities (Majeed and Ahmad, 2006). Accordingly, the volume of exports as well as export sophistication is expected to rise since a rise in investment has a positive impact on labor productivity. However, there is a small catch: As Licandro, Maroto, Puch, Fiesolana, and Domenico (2004) show, productivity increases mostly happen in innovative firms, and more importantly, as Acemoğlu and Üçer (2020) argue, it is not possible to experience productivity increases if this new investment created in the economy channels into nonproductive sectors. Although savings are expected to increase the sophistication of exports, if these conditions

are not met in savings and investment decisions, a negative impact is also possible. Table 1 below shows the summary statistics for the variables in the regression:

Table 1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Log (EXPY)	627	10.1731	0.105807	9.788813	10.56733
REER	627	100.7063	9.803975	63.61	147.1
Log GDP PC 2005	627	9.624518	1.13519	6.418582	11.52664
FDI	627	10.05187	35.24751	-57.5323	449.0809
Pri. Enroll.	615	104.1206	6.375063	89.17204	133.2622
Pop. Growth	627	0.745717	0.858673	-2.25846	3.958797
Dom. Save	627	26.45389	9.515096	7.521804	68.49762

Among the sample used in this paper, Luxembourg has the highest value of export sophistication, whereas Cambodia has the lowest value. Interestingly, the averages of EXPY for the selected period (2005-2015) reveal that Luxembourg has the highest and Cambodia has the lowest value again. In line with the expectations, Luxembourg has the highest per capita income, and Cambodia has the lowest income in this period. Furthermore, it is evident from the data that countries with higher per capita income also have a high value of EXPY. This relationship can be clearly seen from the Table 2 below, which ranks the countries in terms of their export sophistication level and correspondingly shows income levels in the next column.

Table 2: Country Rankings Based on EXPY Values

Countries	**Log (EXPY)**	**Log(GDP PC)**	**Countries**	**Log (EXPY)**	**Log(GDP PC)**
Luxembourg	10.50548	11.59334	Greece	10.16866	10.10921
United Kingdom	10.35886	10.6884	Estonia	10.16388	9.680884
Switzerland	10.3586	11.22934	India	10.15685	7.075927
Ireland	10.33913	10.90189	Mexico	10.15579	9.180072
Cyprus	10.33558	10.27614	Russian Federation	10.15566	9.255882
Malta	10.31727	9.975981	Slovak Republic	10.15474	9.707456
Belgium	10.24854	10.6899	Iceland	10.1513	10.8562
Netherlands	10.23986	10.82464	Colombia	10.1492	8.678988
Brunei Darussalam	10.23911	10.47509	Malaysia	10.14828	9.043952
Sweden	10.23696	10.88586	Bulgaria	10.13622	8.782737

Table 3 (continued): Country Rankings Based on EXPY Values

Countries	Log (EXPY)	Log(GDP PC)	Countries	Log (EXPY)	Log(GDP PC)
Germany	10.23358	10.65217	Romania	10.13198	9.018778
Norway	10.23297	11.37421	Lithuania	10.13038	9.453257
Austria	10.2282	10.75868	New Zealand	10.12693	10.44714
France	10.22721	10.61091	Portugal	10.12594	9.982107
Israel	10.22696	10.31559	South Africa	10.12196	8.845003
Saudi Arabia	10.22688	9.834352	Thailand	10.12149	8.441242
Finland	10.22621	10.75635	Costa Rica	10.1177	8.962854
Denmark	10.2144	10.96357	Morocco	10.11185	7.931408
Spain	10.19267	10.30474	Indonesia	10.11153	7.843846
Slovenia	10.18901	10.04054	Australia	10.1111	10.83698
Croatia	10.18884	9.511635	Tunisia	10.10258	8.283336
Canada	10.18284	10.73503	Brazil	10.09732	9.119459
Italy	10.18121	10.47967	Argentina	10.08461	9.166386
Kazakhstan	10.18044	9.064101	Turkiye	10.07907	9.231978
Korea, Rep.	10.17666	10.07823	Vietnam	10.00465	7.306682
Hungary	10.17441	9.493727	Chile	9.933714	9.392514
Czechia	10.17339	9.84378	Peru	9.919954	8.464676
Latvia	10.17325	9.453713	Cambodia	9.914762	6.672656
Poland	10.16989	9.388825			

Table 2 above represents the powerful connections between export sophistication and economic growth. Countries that have a high income per capita, such as Luxembourg, the United Kingdom, and Switzerland, also have a high export sophistication index, whereas relatively poor countries such as Chile, Peru, and Cambodia have a low export sophistication index. To further investigate this connection, Table 3 below shows the correlation between variables:

Table 4: Correlations Between Variables

	Log (EXPY)	REER	Log GDP PC 2005	FDI	Pri. Enroll.	Pop. Growth	Dom. Save
Log (EXPY)	1						
REER	-0.1455	1					
Log GDP PC 2005	0.6667	-0.2735	1				
FDI	0.2221	-0.0296	0.0855	1			
Pri. Enroll.	-0.3501	0.1641	-0.4006	-0.0686	1		
Pop. Growth	0.0623	0.0891	-0.0169	0.028	0.2755	1	
Dom. Save	0.2807	0.0602	0.2031	-0.0785	-0.148	0.3862	1

According to the Table 3 above, the correlation between initial GDP and the logarithm of export sophistication is relatively high. Although a high value of correlation is expected, this might create multicollinearity problem and yield biased estimates. To control for the multicollinearity and thus robustness of the estimation results, the paper also checks for variance inflation factor (VIF), and the results can be found in Table 4 below:

Table 5: VIF Test

VIF	
Variable	VIF 1/VIF
Pri. Enroll.	1.38 0.723935
Pop. Growth	1.37 0.729332
Dom. Save	1.34 0.746171
Log GDP PC 2005	1.31 0.762465
REER	1.10 0.906160
FDI	1.03 0.971731
Mean VIF	**1.26**

According to the literature, a value of VIF greater than 5 is concerning, and a value greater than 10 means there exists a serious collinearity problem (Witten and James, 2013). As can be seen from Table 4, VIF value is 1.26, which indicates there is no problem of multicollinearity among variables.

3. Estimation Results

The empirical results are presented in the Table 5 below. To control for the robustness of empirical results, both one-step GMM and two-step GMM estimation techniques are used. The first and second columns show the results for one-step GMM, and the third and fourth ones represent the results for two-step GMM, respectively. Although both estimators are asymptotically normal under the conventional assumptions, asymptotic variance of the two-step GMM estimator is lower and is considered to be more powerful than one-step GMM (Hwang and Sun, 2018). Therefore, the preferred estimations are columns 3 and 4, respectively; however, the results of the one-step estimation will also be discussed. In addition, to check for robustness, two types of calculations of the real effective exchange rate are also taken into account. Accordingly, the first and third columns use the broad Real Effective Exchange Rate (170 trading partners), whereas the second and fourth columns use narrow Real Effective Exchange Rate data (65 trading partners).

Table 6: Estimation Results

VARIABLES	(1) Log Expy (one step)	(2) Log Expy (one step)	(3) Log Expy (two step)	(4) Log Expy (two step)
L. Log (EXPY)	0.5942***	0.5253***	0.6726***	0.6210***
	(0.1359)	(0.1886)	(0.0864)	(0.1071)
REER1	0.0053**		0.0043***	
	(0.0026)		(0.0014)	
Log GDP PC 2005	0.1027***	0.1201**	0.0835***	0.0963***
	(0.0366)	(0.0501)	(0.0232)	(0.0285)
FDI	0.0006**	0.0007*	0.0004**	0.0005**
	(0.0003)	(0.0004)	(0.0002)	(0.0002)
Pri. Enroll.	0.0245***	0.0289***	0.0198***	0.0231***
	(0.0080)	(0.0110)	(0.0053)	(0.0065)
Pop. Growth	-0.0820***	-0.0969**	-0.0679***	-0.0795***
	(0.0301)	(0.0400)	(0.0190)	(0.0231)
Dom. Save	0.0043	0.0052	0.0034**	0.0041**
	(0.0027)	(0.0033)	(0.0016)	(0.0019)
REER2		0.0059*		0.0046***
		(0.0033)		(0.0016)
AR(2) Test z value	-0.8862 (0.3755)	-0.5742 (0.5659)	-1.7885 (0.0737)	-0.9936 (0.3204)
Sargan Test chi2 value	1.7252 (0.1890)	1.4089 (0.2352)	0.3049 (0.5808)	1.8401 (0.1749)
Observations	559	559	559	559
Number of country	57	57	57	57

Robust Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

There are two post-estimation tests that should be checked to control for the efficiency of the GMM methodology. These tests are Sargan/Hansen test to control

for over-identifying restrictions and a serial correlation (AR2) test. In case of the Sargan test, the null hypothesis is that there exists independence among instruments and error term, and in case of the serial correlation test, the null hypothesis suggests that there is no serial correlation (Yalta and Yalta, 2012). Furthermore, as Roodman (2007) shows, using more instruments relative to observations yields problematic results. However, as it has been argued before, one of the significant advantages of Kripfganz (2019) version is that it automatically controls for the number of instruments. Table 5 above also shows Hansen over-identification test results as well as second-order autocorrelation values. According to these post estimation test results, the instruments are valid, and there is no serial correlation.

The results of the estimations show that the real effective exchange rate has a positive effect on export sophistication, and this effect is present for all four different specifications. Although the significance of the real exchange rate is low in 2nd column, which uses one-step GMM estimation technique as well as a narrower real exchange data, it still positively contributes to export sophistication. Furthermore, the significance of REER improves in two-step estimations and becomes significant at the 1% level, while the coefficients almost stay the same. These results are in line with the findings of previous papers such as Gan and Cheng (2020) and Gaur et al. (2020) and show that an appreciation in real effective exchange rates improves the sophistication of exports.

In all regressions, lagged level of export sophistication has a significant and positive coefficient, which indicates that the previous year's sophistication positively affects the current level of sophistication, and this result is clear evidence of persistency in export sophistication. In addition to REER and lagged values of sophistication, initial level of GDP per capita positively affects export sophistication. Similar to the effects of initial income, an increase in human capital and foreign direct investment also contributes to an improvement in the sophistication of exports. These findings are also mostly consistent with the literature. For example, Hausmann et al. (2007), and Weldemicael (2012) showed that human capital and initial GDP or GDP per capita positively affect export sophistication, and (Harding and Javorcik, 2012; Weldemicael, 2012) showed that foreign direct investment promotes export sophistication. The coefficients of domestic savings are found to be positive in all four specifications; however, domestic savings does not have a significant impact on export sophistication in the case of one-step GMM estimation. On the other hand, it becomes significant when two-step estimation technique is used. Considering the fact that two-step GMM is preferred to one-step GMM, it can be concluded that domestic savings are also expected to have a positive impact on export sophistication. In terms of population growth, the coefficient for all four specifications is found to be negative and significant. Thus, it can be concluded that a rise in population growth decreases productivity due to the diminishing returns (Becker, Glaeser, and Murphy, 1999) and harms the sophistication of exports.

4. Conclusion and Policy Implications

The importance of exporting a sophisticated and highly productive basket of goods has increasingly gained attention in the literature and has become one of the main factors in reaching sustainable growth. Historically, one of the most important determinants of exports is the real effective exchange rate; however, connections between export sophistication and the real exchange rate have not been fully addressed. The main argument about the link between sophistication and exchange rate is that an appreciation in domestic currency increases the sophistication of exports by allowing firms to reach high quality and more productive inputs as well as decreasing the cost of these inputs, which would be harder with a relatively low real effective exchange rate. Therefore, this paper tries to analyze the effects of fluctuations in the real effective exchange rate on the export sophistication of countries.

To analyze the link between the real effective exchange rate and the sophistication of exports, we use export sophistication data from Abdmoulah (2023), which applies the same methodology in calculating EXPY as Hausmann et al. (2007). However, Abdmoulah (2023) uses the TiVa database, which brings two significant advantages. The trade in services is gradually increasing around the world, and this database puts an emphasis on service exports by introducing several service sectors as well as taking into account goods trade in the database. Secondly, the database also controls for possible double-counting in the data. In addition, this paper uses real effective exchange rate data from Darvas (2021), which is the most comprehensive exchange rate database and calculates the real exchange rate by considering a narrower (65 countries) and a broader (170 countries) trade partners of countries. Furthermore, to consider the dynamic nature of export sophistication and to control for possible estimation problems, such as endogeneity or autocorrelation, dynamic panel data methodology is utilized. Besides, several control variables that are expected to have an impact on export sophistication are also included in the empirical model.

The estimation results show that an appreciation in the real exchange rate contributes to the sophistication of exports, and these results are robust to different specifications as well as different calculation methods of the real exchange rate. Our results are in line with the findings of other papers that examine the relationship between exchange rate and sophistication, such as Cimoli et al. (2013), Gan and Cheng (2020), and Gaur et al. (2020). These papers also showed that a rise in the value of domestic currency relative to foreign currencies yields an increase in export sophistication. In addition, the findings also showed that initial GDP, human capital, FDI, and domestic savings contribute to the sophistication of exports, whereas population growth hinders export sophistication.

Most of the empirical literature about the nexus between exchange rate and exports showed that a depreciation in the exchange rate causes a rise in the export volumes

of countries. This idea might be true, and an undervalued exchange rate provides additional gains and improves the economic performance of countries by allowing them to export a higher volume of goods for a period of time. However, an undervalued exchange rate is found as a barrier in producing and exporting sophisticated and complex goods. Eichengreen (2011) argued a very similar fact: According to him and in parallel with the findings of this paper, a low and undervalued exchange rate prevents countries from moving into more technologically advanced economic activities and eventually suppresses total factor productivity growth. Therefore, maintaining a low and undervalued exchange rate to boost exports for a long period of time will eventually cause a growth and productivity slowdown by preventing the production of countries from jumping simple and low-productive sectors to sophisticated and high-productive sectors. Hence, climbing to the technological ladder requires exchange rate to fluctuate freely at some point and even an appreciation in domestic currency. With a relatively overvalued exchange rate, it would be easier for countries to transform their production and export baskets from low-productivity ones to high-productivity sectors, by capturing the advantages of relatively low-cost imports and investing a higher amount of resources into research and development activities.

This study has potential limitations. For example, the period covered in this study (2005-2015) is relatively short and does not cover current years; however, this limitation exists due to the data availability. Therefore, future studies can use a more current dataset and also employ various empirical methodologies that allow reporting country-specific estimates.

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Ethics Statement: The author declares that ethical rules have been followed in all the preparation processes for this study. In case of a contrary situation regarding scientific ethics issues, all responsibility belongs to the authors of the study and Çankırı Karatekin University Journal of Faculty of Economics and Administrative Sciences has no responsibility.