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RESEARCH ARTICLE • FORSCHUNGSARTIKEL • ARAŞTIRMA MAKALESİ

THE MODERATING EFFECT OF EXCHANGE RATE VOLATILITY ON EXPORT DIVERSIFICATION AND ECONOMIC GROWTH NEXUS IN THE G7 COUNTRIES

G7 ÜLKELERİNDE DÖVİZ KURU OYNAKLIĞININ İHRACAT ÇEŞİTLENDİRMESİ VE EKONOMİK BÜYÜME İLİŞKİSİ ÜZERİNDEKİ YÖNLENDİRİCİ ETKİSİ

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Abstract

This paper examines the nexus between export diversification and economic growth in the G7 countries and how exchange rate volatility affects this relationship. Using data spanning from 1995 to 2018, the study applies the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) techniques to examine the long-run impact of export diversification on economic growth. The results show that export diversification significantly enhances economic growth in the G7 countries. Nonetheless, the growth-enhancing effect of export diversification is inimically affected by exchange rate volatility. We also document that trade openness significantly accelerates growth which supports the trade-led growth hypothesis in the bloc. The study recommends that export diversification should be prioritized in enacting strategies for stimulating and sustaining long-term economic growth in the G7 alliance. A policy agenda to lessen trade restrictions will also increase international trade activities, and therefore leads to long-term economic growth in the bloc.

Keywords: Export diversification, exchange rate volatility, economic growth, G7 countries
JEL Classification: F13, F31, F43

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Öz

Bu çalışmada, G7 ülkeleri için ihracat çeşitlendirmesi ile ekonomik büyüme arasındaki uzun dönemli ilişki ve döviz kuru oynaklığının bu ilişkiyi nasıl etkilediği incelenmektedir. Çalışmada, 1995-2018 dönemi için Tam Düzeltilmiş En Küçük Kareler (TDEKK) ve Dinamik En Küçük Kareler (DEKK) tekniklerini uygulanmıştır. Çalışmanın sonuçları, ihracat çeşitlendirmesinin G7 ülkelerinde ekonomik büyümeyi önemli ölçüde artırdığını göstermektedir. Bununla birlikte, ihracat çeşitlendirmesinin büyümeyi artırıcı etkisinin döviz kuru oynaklığından olumsuz olarak etkilendiği ortaya konulmuştur. Ayrıca, ticari dışa açıklığın büyümeyi önemli ölçüde hızlandırdığı ortaya konulmuştur. Literatürde, G7 ülkelerindeki ihracat çeşitlendirmesi ve ekonomik büyüme ilişkisini inceleyen spesifik bir çalışma olmaması bu çalışmanın özgün değerini oluşturmaktadır. Buna ek olarak, literatür ayrıntılı olarak incelendiğinde döviz kuru oynaklığının ihracat çeşitlendirme-büyüme bağlantısı üzerindeki düzenleyici etkisini dikkate alan spesifik bir çalışmanın bulunmaması sebebiyle de çalışmanın literatüre katkı sağlayacağı ifade edilebilir.
Anahtar Kelimeler: İhracat çeşitlendirmesi, döviz kuru oynaklığı, ekonomik büyüme, G7 ülkeleri
JEL Sınıflandırılması: F13, F31, F43

1. Introduction

The G7 (the Group of Seven) is an intern-governmental organization comprising the world's seven wealthiest so-called advanced economies per the International Monetary Fund country classification: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. In addition to economic governance issues, these countries convene periodically to deliberate on global security and energy-related policies. Also, as outlined in the G7 trade *acquis,* the bloc emphasizes the significance of free trade and investment for long term growth, as well as the commitment to combat protectionism.

The G7 economies have significantly contributed to international trade in recent years, particularly export activities. According to data from the World Bank (2019), aside from Canada, which ranked eleventh, all the other countries in the G7 alliance were among the top ten world largest exporters in 2019. After China, which ranked as the largest exporter, the United States, Germany, Japan, France, and the United Kingdom dominated as the second to the sixth largest exporters, respectively. The increase in global export patterns has stimulated the interest of policymakers and researchers, sparking a debate about the economic consequences of exports (Akhter, 2015; Nguyen, 2016; Sultanuzzaman et al., 2018; Devkota, 2019; Sahin, 2019; Temiz Dinç and Gökmen, 2019; Okyere and Jilu, 2020; Ali et al., 2021).

Against this backdrop, the purpose of this study is to determine whether exports fuel economic growth in the G7 countries. Specifically, we look at how export diversification drives economic growth. According to David Ricardo's comparative advantage theory, countries can thrive through specialization. Thus, suggesting that export specialization or concentration is advantageous to an economy since it trades a good or service that it can inexpensively produce. Academics, on the other hand, have varying opinions as to whether economies should perhaps specialize or diversify their exports. Contrary to David Ricardo's view, Chandra et al. (2007) contend that economies have to diversify their exports in order to attain rapid economic growth. Matthee and Naude (2007) posit that the diversification of exports favorably influences economic growth in the long term. Also, export

diversification presents countries the opportunity to develop new technologies to boost production, resulting in higher returns and growth (Hodey et al., 2015). Likewise, export diversification may play an important role in ensuring the stability of export revenues and thereby reducing macroeconomic fluctuations by constituting an insurance mechanism against possible price and market fluctuations (Altun & Benli, 2021). Given the perceived benefits of export diversification, and considering the contributions of the G7 countries to the overall global exports, it is imperative to examine whether export diversification presents greater growth prospects for G7 economies. To the best of our knowledge, there is no research on the export diversification-growth relationship specifically in the G7 economies. We further argue that the exchange rate volatility may significantly affect the impact of export diversification on growth since export receipts are converted to the home country's currency at the prevailing exchange rate. Based on extensive literature review, we are not aware of any empirical research which considers the moderating effect of exchange rate on the export-growth relationship. With this, our study fills a significant gap in the literature. In addition, the study supplements the current global debate on the export-led growth relationship. Likewise, we apply the panel cointegration techniques within the fully modified OLS and dynamic OLS framework on more recent data. These analytical strategies are more suitable for modelling long-run relationships and handling endogeneity issues.

The remainder of the paper is outlined as follows: The second section reviews the literature. The third section covers the data and methods. Section 4 presents the empirical findings, and Section 5 concludes the paper.

2. Literature Review

Theoretically, the work of Ricardo (1817), dubbed "the theory of comparative advantage", highlights how exports drive growth. Ricardo endorsed the idea of countries focusing on trade domains where they possess a comparative advantage over their trade allies. In accordance with this theory, if nations exclusively export commodities they specialize in with considerably cheaper costs, they can boost output performance. Heckscher (1919) and Ohlin (1933) make a significant improvement to the Ricardian concept, which they termed as the Heckscher-Ohlin model. This model is a nuanced form of the comparative advantage hypothesis, which stipulates that countries derive more trade benefits by exporting commodities that utilize local factor endowments that are relatively abundant or high in supply. Contrary to the export specialization theories, Kuznets (1971) encourages the concept of export diversification. Kuznets asserts that for a country to achieve long-term growth, it should have the potential to produce and export a varied array of products. In support of Kuznets (1971), Mundenda et al. (2014) postulats that export diversification is deemed desirable for economic growth since it aids in reducing the volatility of export revenues.

Empirically, the studies on the effect of export diversification on economic growth have yielded contradictory findings. That is, export diversification has been noted in the literature to have both positive and negative effects on growth. For instance, in a panel study involving 88 economies,

Kadyrova (2011) examines the relationship between export diversification and growth over the years 1962-2009. Using the system GMM technique, the study evidences a positive influence of export diversification on growth, particularly in developing economies. In Costa Rica, Ferreira and Harrison (2012) test whether export diversification drives growth using a dataset covering from 1965-2006. The authors reveal that export diversification has no long-run effect on growth. Cadot et al. (2011) and Aditya and Acharyya (2013) indicate that the impact of export diversification on growth is U-shaped, suggesting that export diversification only enhances growth up to a certain threshold. Hamed et al. (2014) examine the link between export diversification and the growth of developing economies. Using the GMM technique with data extending from 2000-2009, the findings demonstrate that improving export diversification along with decreasing export concentration significantly enhances growth in the selected countries. Mudenda et al. (2014) find a significant positive link between export diversification and economic growth in the Sub-Sharan African countries,. Similarly, Hodey et al. (2015) notes that export diversification significantly improves growth in the Sub-Saharan African region. Relying on the dynamic OLS, Rath and Akram (2017) report that the growth in total factor productivity in the South Asian countries is positively motivated by export diversification. Deploying the ARDL framework, Duru and Ehidiamhen (2018) examine how diversification of exports affects the growth of the Nigerian economy during the period 1980-2016. The authors find an insignificant effect of diversification on growth. Fu et al. (2019) analyze the impact of diversifying export on the growth of provinces in China with data covering the years 2000-2006. The study indicates that economic growth is stronger in regions where export diversification is high. Lee and Zhang (2019) indicates that growth volatility is lowered by export diversification and no clear proof indicates that diversification leads to increased growth in lower-income economies. In a sector-level analysis in Thailand, Jongwanich (2020) evidences that export diversification matters for some sectors such as automotive and electronics. In the BRICS economies, Siswana and Phiri (2021) applied several cointegration techniques to explore the relationship between export and growth for the period 1995-2017. The study establish that export diversification has a negative influence on growth. Yama and Wani (2021), using a vector autoregressive model, assess whether export diversification affects economic growth in Afghanistan over the period 2008-2018. Evidence from the VAR estimation shows that economic growth is positively driven by export diversification. Studies such as Benli (2020) however documents that there is no long run relationship between export diversification and economic growth in some selected emerging economies.

Given that the study takes into account how exchange rate volatility affects export diversification and economic growth relationship, we briefly discuss the effect of exchange rate volatility on economic growth as documented in the literature. Undoubtedly, prior studies have mainly reveal that the exchange rate volatility inversely affects economic growth. For instance, Barguellil et al. (2018) establish that the exchange rate volatility reduces growth in emerging and developing economies and this effect magnifies in the case of flexible exchange rate regimes. Umaru et al. (2018) find that the volatility of the exchange rate in West Africa significantly contracts the rate of economic growth. Alagidede and Ibrahim (2017) note that exchange rate volatility inversely affects economic growth in Ghana. A similar finding is established by Ahiabor and Amoah (2019) in the Ghanaian context.

Using different indicators of exchange rate volatility, Morina et al. (2020) evidence that volatility of exchange rates is detrimental to the growth of CEE economies. Ozata (2020) reports a negative influence of volatility of exchange rate on the rate of growth in Turkey.

Our paper advances the prevailing literature by demonstrating how exchange rate volatility mediates the link between export diversification and the growth of G7 economies.

3. Methodology

3.1. Data and Variables

Our study employed a panel dataset spanning from 1995 to 2018. Economic growth serves as the dependent variable. The primary independent variable is export diversification, while the moderating factor is exchange rate volatility. Trade openness, foreign direct investment (FDI), and inflation are control variables. Data for the export diversification index is sourced from the United Nations Conference on Trade and Development (UNCTAD) database. For the data on exchange rates, we use time-series data on exchange rates from the Federal Reserve Economic Database. We also collect the data for our dependent variable (economic growth) and the control variables from the World Bank. The data are transmuted into logarithm form for empirical analysis.

In measuring the variables, economic growth is gauged using GDP per capita (Constant 2010 US$). Export diversification is commonly quantified using the Finger-Kreinin index (FKI), the Herfindahl-Hirschman index of market concentration (HHI) and the Theil index. The FKI and HHI are published by the UNCTAD while the Theil index is from the IMF. The FKI compares export structures across countries while the HHI is a country-specific export diversification measure. On the other hand, the Theil index gauges export diversity within and among sectors.

The modified Finger and Kreinin (1979) Index (FKI) of export diversification is used to measure the level of export diversification in this study. The strength of this measure is that it is a relative index which indicates the extent to which the structure of exports of a given country differs from the world average (Gylfason, 2017). The index spans from 0 to 1, with scores closer to 1 implying greater export diversification to the overall global trend, and scores nearer to 0 signify greater convergence to the global export pattern. The following formula is employed in the calculation of the Finger-Kreinin Index:

$$S_j = \frac{\sum_i / h_{ij} - h_i /}{2} \qquad \textbf{(1)}$$

From equation (1), h_{ij} represents the percentage of product *i* in the overall export value of country *j,* and *hi* symbolizes product *i* share in the overall global exports.

In computing exchange rate volatility, we use the standard deviation of the monthly real effective exchange rate data following prior studies (Bahmani-Oskooee and Harvey, 2011; Baek, 2013; Morina

et al., 2013). The volume of FDI inflows as the share of GDP measures foreign direct investment. Trade openness is the value of imports and exports in terms of percentage of GDP, while inflation is gauged by consumer prices in annual percentage terms.

The summary statistics for the variables in their non-logarithmic forms are shown in Table 1. GDP per capita has an average value of US$41,525.560. The mean of export diversification is 0.325 with a maximum of 0.456 and a minimum of 0.229. We infer that there is less export diversification relative to the global export pattern in the G7 nations, given that the average value of export diversification is far from 1. Also, export diversification based on the standard deviation values is considered the least volatile series in our dataset. Aside from trade openness and inflation, the variables show positive skewness.

Table 1: Descriptive Statistics

	GDP	EXD	EVOL	TOP	FDI	INF
Mean	41525.560	0.325	1.957	50.595	2.180	1.595
Maximum	54832.980	0.456	10.717	88.596	12.763	5.235
Minimum	30679.540	0.229	0.287	16.679	-0.726	-1.353
Std. Dev.	5193.863	0.057	1.500	18.339	2.231	1.078
Skewness	0.291	0.007	2.411	-0.050	2.273	-0.128
Kurtosis	2.370	1.878	11.328	2.244	9.328	3.279

3.2. Empirical Model

The study estimates two models. First, we examine the direct effect of export diversification on economic growth. The second model looks at the mediating effect of exchange rate volatility on the export diversification-growth relationship. Based on these objectives, the basic empirical models for the study are specified as follows:

$$ln\text{GDP}_{it} = \alpha_0 + \beta_1 ln\text{EXD}_{it} + \beta_2 ln\text{TOP}_{it} + \beta_3 ln\text{FDI}_{it} + \beta_4 ln\text{INF}_{it+} \varepsilon_{it} \quad \textbf{(2)}$$

$$ln\text{GDP}_{it} = \alpha_0 + \beta_1 ln\text{EXD}_{it} + \beta_2 ln\text{EXD}^{*} ln\text{EVOL}_{it} + \beta_3 ln\text{TOP}_{it} + \beta_4 ln\text{FDI}_{it} + \beta_5 ln\text{INF}_{it+} \varepsilon_{it} \quad \textbf{(3)}$$

From the above equations, GDP, EXD, EVOL, TOP, FDI, and INF denote economic growth, export diversification index, exchange rate volatility, trade openness, foreign direct investment, and inflation in a specific country *i* at period *t,* respectively. ε signifies the error term.

3.3. Analytical Procedures

Prior to estimating the models, various preliminary tests are conducted. We first examine if the variables have cross-sectional dependence (CD), which may lead to inaccurate findings. The CD test developed by Pesaran (2004) is employed to determine whether or not the selected variables show cross-sectional dependence. Second, the panel series are examined for unit root using the

cross-sectional augmented Dickey-Fuller (CADF) method of panel unit root test by Pesaran (2007). Also, we apply the Johansen-Fisher panel cointegration test to determine if the variables are cointegrated. Finally, the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) are used to examine the relationship among the variables. These methods are appropriate for modelling long-run relationships and also fit for dealing with endogeneity issues (Balsalobre-Lorente et al., 2019).

4. Empirical Results

4.1. Cross-Sectional Dependence (CD) Test

Table 2 summarizes the CD test results. Except for export diversification, the null hypothesis that the series exhibit cross-sectional independence is rejected based on the significance level of the variables. The results, thus, provide a compelling indication of the existence of cross-sectional dependency in the dataset.

Table 2: Cross-sectional Dependence (CD) Test

Variable	Statistic	Prob.
*ln*GDP	16.514	0.000***
*ln*EXD	1.164	0.245
*ln*EVOL	3.561	0.000***
*ln*TOP	9.948	0.000***
*ln*FDI	6.523	0.000***
*ln*INF	9.582	0.000***

*Note: *** represents statistical significance at the 1% level*

4.2. Panel Unit Root Test

Given the existence of cross-sectional dependence, it is critical to conduct a panel unit root test using the second-generation methods to establish the integration of the series. Therefore, the CADF panel unit root test is employed, which takes into account the issue of cross-sectional dependence. Also, it is worth noting that since export diversification indicates cross-sectional independence, we use the Fisher ADF test to determine its order of integration. The results of the unit root test in Table 3 suggest that at level (I(0)), economic growth, export diversification, and trade have unit roots, indicting non-stationarity. However, at first difference (I(1)), all the variables are stationary.

Table 3: Panel Unit Root Test

	Level I(0)	First Difference I(1)
Variable	**z (t-bar)**	**z (t-bar)**
*ln*GDP	0.705	-2.424***
*ln*EXD	10.198	62.740***
*ln*EVOL	-6.229***	-11.951***
*ln*TOP	0.176	-4.321***
*ln*FDI	-4.899***	-9.618***
*ln*INF	-3.438***	-6.122***

*Note: *** represents statistical significance at the 1% level*

4.3. Panel Cointegration Test

After verifying the unit root properties of the series, we check for the cointegration status of the variables using the Johansen-Fisher panel cointegration test. From the results in Table 4, it is revealed that in all scenarios (Trace and Max-eigen tests), the variables are cointegrated in the long term.

Table 4: Panel Cointegration Test

	Scenarios			
	GDP EXD TOP FDI INF		GDP EXD EXD*EVOL TOP FDI INF	
H_0:r	λ_{Trace}	$\lambda_{Max\text{-}eigen}$	λ_{Trace}	$\lambda_{Max\text{-}eigen}$
r = 0	152.8***	103.6***	231.1***	121.6***
r ≤ 1	68.55***	37.02***	128.3***	70.95***
r ≤ 2	41.27***	20.61*	94.96***	59.92***
r ≤ 3	32.26***	20.04*	52.06***	35.55***
r ≤ 4	35.85***	35.85***	29.24***	17.80
r ≤ 5	-	-	35.78***	35.78***

*Note: * and *** represent statistical significance at the 10% and 1% levels, respectively.*

4.4. FMOLS and DOLS Regression Estimates

The empirical findings for both FMOLS and DOLS estimation techniques are presented in Table 5. In model 1, the direct effect of export diversification on economic growth is depicted. Model 2 examines the moderating effect of exchange rate volatility on the export diversification-growth relationship.

Table 5: FMOLS and DOLS Regression Results

	FMOLS		DOLS	
Variable	**Model 1**	**Model 2**	**Model 1**	**Model 2**
*ln*EXD	0.281**	0.315**	0.233*	0.250*
	(0.035)	(0.018)	(0.081)	(0.062)
*ln*EXD**ln*EVOL	-	-0.071*	-	-0.035
		(0.069)		(0.391)
*ln*TOP	0.187**	0.214**	0.215**	0.230**
	(0.041)	(0.021)	(0.014)	(0.010)
*ln*FDI	0.018	0.0185	0.013	0.013
	(0.119)	(0.113)	(0.306)	(0.302)
*ln*INF	-0.004	-0.006	-0.007	-0.007
	(0.751)	(0.663)	(0.604)	(0.578)
R^2	0.643	0.642	0.653	0.658
Adj. R^2	0.614	0.610	0.628	0.630

*Note: P-values are in parentheses. * and ** represent statistical significance at the 10% and 5% levels, respectively.*

From the analyses, it is clear that in terms of the coefficient sign, the FMOLS results are similar to the estimates of the DOLS technique. For both techniques, the estimates in model 1 and model 2 indicate that export diversification has a significant positive effect on economic growth. The finding implies that diversification of exports is an appropriate trade strategy for the G7 countries to boost long-term economic growth. In other words, the transition from export specialization to diversification will benefit the G7 economies significantly. Our evidence is analogous to those established in prior studies (Hamed et al., 2014; Hodey et al., 2015; Jongwanich, 2020; Yama and Wani, 2021). Regarding the moderating effect of exchange rate volatility, the results in model 2 for both estimation techniques indicate that export diversification in the presence of exchange rate volatility reduces economic growth, though the impact is insignificant in the case of the DOLS technique. This suggests that during periods of significant changes in the value of currencies of the G7 nations relative to the currencies of their trading partners, their export receipts reduce, and therefore are inadequate to support growth. Precisely, as the currencies of G7 member states strengthen, countries importing from the G7 alliance may experience an increase in transaction risk and costs resulting from currency volatility. Hence, they will reduce imports from the G7, which undesirably affects the export earnings of the G7 countries.

For the control variables, trade openness exerts a significant positive influence on growth at a 5% level of significance for both techniques employed in models 1 and 2. The finding demonstrates that trade liberalization significantly contributes to the long-term growth of the G7 economies and thus confirming the validity of the trade-led growth paradigm in the bloc. Furthermore, in both FMOLS and DOLS methods, foreign direct investment positively affects growth, albeit statistically insignificant. Likewise, inflation insignificantly dampens economic growth in the G7 countries.

5. Conclusion and Discussion

In the economic literature, the export-growth causal link has been widely debated. In recent years, a burgeoning interest has emerged on how export composition, particularly export concentration and export diversification influence growth. In line with this, our paper examines the nexus between export diversification and economic growth in the G7 nations, considering how exchange rate volatility affects this relationship. The study utilized a panel dataset covering the period 1995-2018 and applies the fully modified OLS and dynamic OLS techniques. Evidence from the regression analyses generally demonstrates that export diversification significantly enhances growth in the G7 countries. Nonetheless, the growth-enhancing effect of export diversification is inimically affected by exchange rate volatility. We document that trade openness significantly accelerates growth, supporting the trade-led growth hypothesis. The study further indicates that foreign direct investment and inflation have an insignificant impact on the growth of the G7 economies.

In line with the results, the study recommends that export diversification should be prioritized in enacting strategies for stimulating and sustaining long-term economic growth in the G7 bloc. However, the decision to specialize in the production and export of certain products should not be deserted completely, particularly for products with stable demand and those that require specialized skills. This will help stabilize export revenues, especially in periods of high exchange rate volatility. In addition, a policy agenda to lessen trade restrictions will increase international trade activities, and therefore leads to long-term economic growth. Our study provides a broader analysis of the impact of export diversification on growth. We recommend future studies to examine the export diversification-growth nexus for each of the countries in the G7 alliance to establish whether the findings of this study are congruent with the results of the country-specific analysis.

Author Contribution

CONTRUBUTION RATE	EXPLANATION	CONTRIBUTORS
Idea or Notion	Form the research idea or hypothesis	Ibrahim Nandom YAKUBU Ayhan KAPUSUZOGLU Nildag Basak CEYLAN
Literature Review	Review the literature required for the study	Ibrahim Nandom YAKUBU Ayhan KAPUSUZOGLU Nildag Basak CEYLAN
Research Design	Designing method, scale, and pattern for the study	Ibrahim Nandom YAKUBU Ayhan KAPUSUZOGLU Nildag Basak CEYLAN
Data Collecting and Processing	Collecting, organizing, and reporting data	Ibrahim Nandom YAKUBU Ayhan KAPUSUZOGLU Nildag Basak CEYLAN
Discussion and Interpretation	Taking responsibility in evaluating and finalizing the findings	Ibrahim Nandom YAKUBU Ayhan KAPUSUZOGLU Nildag Basak CEYLAN

Conflict of Interest

No conflict of interest was reported by the authors.

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