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Economic Diversification and Growth in Euro-Mediterranean Countries: A Granger Causality Approach in Panel Data

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ABSTRACT

This paper develops and tests the relationship between economic diversification and growth in Euro-Mediterranean countries. The analysis covers the period 1975-2013 in a panel data of 35 Euro-Med countries, and introduces a bootstrapped Granger-causality approach in order to analyze the unidirectional causality, and likely the bidirectional causality between economic diversification and growth. Overall, results provide robust empirical evidence of a positive impact of growth on economic diversification in most of developing countries benefiting from diversifying their economies in contrast to developed countries that perform with more economic specialization.

1. Introduction

Historically, there was a large consensus in the researchers and policy-makers community which argues that economic crises exposed one of the major weaknesses of a number of worldwide economies, namely their dependence on too few export commodities and a concentrated economy in one or two sectors. Such dependence makes many countries vulnerable to fluctuations in international markets.

The regional integration in Euro-Mediterranean region is particularly important to enhance economic diversification, especially given the favorable geographic localization and the benefits of diversified resources. Economic partnerships offer the opportunity to expand economic options, especially for developing countries in the region.

Economic diversification and growth has been intensively studied in developed countries. From one hand, some of the research works indicate a strong positive relationship between growth and economic diversification. From another hand, other studies support evidence of a negative or even insignificant relationship between economic diversification on growth in the bi-directional sense.

This study aims to measure the level of economic diversification in Euro-Mediterranean countries and to understand the nature of the relationship between it and economic growth. The paper contributes to the literature in several ways. It uses a panel data approach with an updated range of data from 1975 to 2013. The Study includes both developed and developing countries in the Euro-Mediterranean region. Moreover, the paper introduces a quantitative index to assess potential links between economic diversification and growth when some crucial factors, like economic integration, are considered. Finally, the paper uses a very relevant econometric framework, namely the Bootstrapped Granger-causality test in panel data to analyze the relationship between economic diversification and growth.

Overall, results show that economic diversification is associated to growth, but in different senses. Furthermore, the hypothesis of a Granger-causality from growth to economic diversification is more confirmed in Euro-Mediterranean economies. The improvement of growth levels is a key factor for measuring diversification but is not sufficient to make economies more diversified or more specialized, in other words the impact is positive for some countries and negative for others in Euro-Mediterranean region. However, so far the study tries to give a more detailed explanation about this divergence.

The paper is organized as follows. Section two presents a brief review of the literature on the economic diversification and growth nexus. Section three provides details of the data and empirical methodology. Section four is devoted to the obtained results. Finally, section five concludes and provides some policy implications.

2. Empirical Literature Review

One of the main advantages of economic diversification which has been put forward by economists is that it tends to increase growth. However, the literature engages two strands with two main questions on the relationship between economic diversification and growth: first, does economic diversification affect growth? And secondly, can a country boost its economic performance by diversifying its economy?

Moreover, the relationship between economic diversification and growth has been extensively investigated, but with a high focusing on exports and international trade. Some empirical studies have shown that economic diversification is contributing to higher GDP growth. Under this consideration, a country should avoid heavy dependence on limited economic activities since it impacts unfavorably the state

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ability to partially offset fluctuations in some economic sectors with other ones characterized which a relative stability. Hence, diversification is a key element to reduce instability and enhance growth (Gutiérrez-de-Piñeres & Ferrantino, 2000; Balaguer & Cantavella-Jordá, 2004; Hammouda et al., 2006; Love, 1986; Greenaway, Morgan & Wright, 1999; Feenstra & Kee, 2004).

However, the positive relationship between economic diversification and growth is not always revealed in the literature. For instance, others works stand up for the fact that this relationship is influenced by other supporting factors such as finance, openness, human capital, investment and savings policies, or even the time dimension, as long as it is also relevant to analyze both the short and the long run relationship between diversification and growth. This implies that the impact of economic diversification on growth is weaker in the short run than in the long run. The adjustment will, however, not take long, notably because economic growth is also found to contribute to increased diversification.

In a more developed stage, the relationship between economic diversification and growth is confirmed only among developed economies, but this was not the case among developing countries. Therefore, a certain minimum level of development is crucial for economic diversification to impact on growth (Michaely, 1977). Moreover, no evidence supporting diversification-induced growth was found in the works of Ferrantino (2000) and Chang et al. (2000).

However, the conflicting results could be potentially traced back to different levels of disaggregation and types of regression models used (cross-sectional versus time series), so more work needs to be done for a better understanding of the relationship between economic diversification and growth.

3. Data and Methodology

A large body of research on economic diversification and growth studies the relationship between them by including cross-country regressions or panel studies.

3.1. Data and Variables Description

Annual data involving 35 Euro-Mediterranean countries, including developed and developing countries from 1975 to 2013 was used in the analysis. The used variables are the logarithm of the GDP and the logarithm of the Herfindahl-Hirschman Index for measuring diversification (HHI). The data are obtained from World Bank and International Monetary Fund . In what follow, the natural logarithms of these two variables are denoted as lnGDP and lnHHI respectively.

To investigate panel causal links between economic diversification and growth, it is recommended to use appropriate metrics of these variables. Measuring growth is a relative easy process compared to economic diversification. Researchers have constructed various scalar measures of regional economic diversity using different economic theories, but these measures are sometimes difficult to obtain consistently across countries for an adequate time period for a causality study.

For example, the most used indexes for measuring diversification in the empirical literature are the Ogive index of economic diversity, the Entropy index, the Location Quotient and the Herfindahl-Hirschman Index. Because of its simplicity, the HHI index, is a widely-used measure of diversification/concentration in an economy, industry or a market (Scherer, 1980; Tauer, 1992). The HHI index indicates the extent to which a particular economy is dominated by a few sectors or not. Accordingly, this paper considers the HHI which can be expressed by squaring the employment shares of all sectors in an economy and then summing the squares, as follows (Hirschman, 1989):

$$HHI = \sum_{i=1}^{n} (ES_i)^2 \quad (1)$$

Where ES_i represents the share of employment in the i^{th} sector and n the number of sectors in an economy. The HHI varies from zero, meaning that the economy has a large number of sectors with small and relatively equal employment shares (high diversification) to one, where an economy is based on a one single prevailing sector with a full-employment (full specialization). Thus, a situation with a less concentration (or high diversification) in the dominant sector leads to low values of the HHI, against the situation where an increase indicates high concentration (or a less diversification) in the dominant sector. Therefore, according to the HHI, more equal distribution of employment among a large number of sectors means higher level of economic diversity. In this paper, three main economic sectors are included in the empirical analysis, namely agricultural, industrial and services sectors (n = 3).

3.2. Econometric framework

From the previous literature review, the causal relationship between economic diversity and growth could be in either one or both directions. It is also possible to even have no interdependency.

This study uses the approach of Bootstrapping Panel Granger-causality developed by Kónya (2006) to empirically test the causal relationship between economic diversification and growth by considering contemporaneous correlation across countries and cross-country heterogeneity. In this case, causality tests are considered as an extension of the standard time series Granger-causality tests, but in a cross-sectional dimension.

For each individual or entity, a variable *x* Granger-cause a variable *y* if *y* can be better predict using all available information than in the case where the information set used does not include *x* (Granger, 1969). Hence, economic diversification is said to Granger-cause a growth if the lagged values of economic diversification helps to forecast more efficiently the growth levels. Even if the Granger-causality test for time series data has been well developed, a better way of testing for causality is to combine both the cross-sectional and time series data, and to perform the so-called panel Granger-causality test (Hurlin & Venet, 2001; Hurlin, 2004; Hurlin, 2007). Consequently, applying Granger-causality test in panel data is more efficient than using only the time series data (Hurlin & Venet, 2001).

Overall, the two main used approaches in testing Granger-causality in panel data are the works developed by Hurlin (2001), and the one of Kónya (2006). However, the Hurlin's (2008) approach controls for the heterogeneity, but it is not able to take into account the cross-sectional dependence. The Hurlin work's drawback does not exist in the Kónya's (2006) approach, where both the *cross-sectional dependence* and the *heterogeneity* are taken into account. Moreover, the Kónya's approach does not require any pre-testing for panel unit root and co-integration. In a country-by-country analysis, the possibility of Granger-causality between lnGDP and lnHHI can be modeled using the following Seemingly Unrelated Regressions (SUR) systems (Kónya, 2006):

$$\begin{cases} lnGDP_{1,t} = \alpha_{1,1} + \sum_{l=1}^{ml(lnGDP)_1} \beta_{1,1,l} lnGDP_{1,t-1} + \sum_{l=1}^{ml(lnHHI)_1} \gamma_{1,1,l} lnHHI_{1,t-1} + \varepsilon_{1,1,t} \\ lnGDP_{2,t} = \alpha_{1,2} + \sum_{l=1}^{ml(lnGDP)_1} \beta_{1,2,l} lnGDP_{2,t-1} + \sum_{l=1}^{ml(lnHHI)_1} \gamma_{1,2,l} lnHHI_{2,t-1} + \varepsilon_{1,2,t} \\ \vdots \\ lnGDP_{N,t} = \alpha_{1,N} + \sum_{l=1}^{ml(lnGDP)_1} \beta_{1,N,l} lnGDP_{N,t-1} + \sum_{l=1}^{ml(lnHHI)_1} \gamma_{1,N,l} lnHHI_{N,t-1} + \varepsilon_{1,N,t} \end{cases} \quad (2)$$

And:

$$\begin{cases} lnHHI_{1,t} = \alpha_{2,1} + \sum_{l=1}^{ml(lnGDP)_2} \beta_{2,1,l} lnGDP_{1,t-1} + \sum_{l=1}^{ml(lnHHI)_2} \gamma_{2,1,l} lnHHI_{1,t-1} + \varepsilon_{2,1,t} \\ lnHHI_{2,t} = \alpha_{2,2} + \sum_{l=1}^{ml(lnGDP)_2} \beta_{2,2,l} lnGDP_{2,t-1} + \sum_{l=1}^{ml(lnHHI)_2} \gamma_{2,2,l} lnHHI_{2,t-1} + \varepsilon_{2,2,t} \\ \vdots \\ lnHHI_{N,t} = \alpha_{2,N} + \sum_{l=1}^{ml(lnGDP)_2} \beta_{2,N,l} lnGDP_{N,t-1} + \sum_{l=1}^{ml(lnHHI)_2} \gamma_{2,N,l} lnHHI_{N,t-1} + \varepsilon_{2,N,t} \end{cases} \quad (3)$$

Where *ml* is the maximum lags in the SUR systems, and *N* the number of individuals in the panel. Therefore, *first*: there is one-way Granger-causality in country *i* running from lnHHI to lnGDP in the SUR system (2) if there is at least one coefficient $\gamma_{1,i}$ different from zero, but in the SUR system (3) all coefficients $\beta_{2,i}$ are zero. *Second*: there is a one-way Granger-causality from lnGDP to lnHHI if in the SUR system (2) all coefficients $\gamma_{1,i}$ are zero but in the SUR system (3) there is at least one coefficient $\beta_{2,i}$ different from zero. *Third*: there is two-way Granger-causality between lnGDP and lnHHI if neither all coefficients $\beta_{2,i}$ nor all $\gamma_{1,i}$ are equal to zero; and there is no Granger causality between lnGDP and lnHHI if all coefficients $\beta_{2,i}$ and $\gamma_{1,i}$ are equal to zero (Kónya, 2006).

After explaining the estimation method allowing to perform the Bootstrap Granger-causality test, there is some consideration to take into account, mainly the problem of contemporaneous correlation across countries. As mentioned earlier in this paper the *cross-sectional dependence* and the *homogeneity* tests are a necessary precondition to perform Granger-causality test in panel data. Moreover, since the selected countries share many factors, this condition become more confirmed, because in the absence of contemporaneous correlation the regression in (2) and (3) become easier since all the equations are a classical regression that can be estimated one-by-one with OLS. However, in the presence of contemporaneous correlation, the OLS estimator is not efficient because of information's loss. This is the reason why the SUR regression was proposed by Zellner (1962) as an efficient alternative of the simple OLS regression.

Furthermore, before the estimation, there is another problem to deal with, namely the appropriate number of lags, because the causality test results may depend critically on the lag structure (Kónya, 2006). Both too few and too many lags may cause problems and unfortunately, there is no simple rule to decide on the maximal lag (Kónya, 2006). Hence, the idea is to combine a maximum lags which range from 1 to 4, and choose the two combinations which fit some information criteria developed in the next section of this paper. It is recommended to not allow to the number of lags to vary across countries, that is to say the two appropriate combinations of lags remain the same for all countries in the panel data.

4. Results

The literature on information criteria is vast (Akaike, 1973; Sawa, 1978; Raftery, 1995, Judge et al., 1985), but usually it is about calculating two main information criteria to compare SUR models, namely Akaike's (1974) information criterion (AIC) and Schwarz's (1978) Bayesian information criterion (BIC). In general, a smaller value of information criterion indicates a better-fitting of the model. Thereafter, it would be wiser to choose the combinations which minimize the (AIC) and (BIC) defined as (Kónya, 2006):

$$AIC = \frac{-2\ lnL + 2k}{N} \quad (4)$$

$$BIC = \frac{-2\ lnL + k\ lnN}{N} \quad (5)$$

Where *lnL* is the maximized log-likelihood of the model, k is the number of parameters estimated, and *N* is the sample size.

The lags' combinations give as a result, one lag of lnGDP with two lags of lnHHI in the case of causality from lnHHI to lnGDP; and four lags of lnGDP with one lag of lnHHI in the case of causality from lnGDP to lnHHI.

4.1. Cross-sectional dependence & slope homogeneity tests

In the econometric literature, there is a growing trend in approaches for testing substantial cross-sectional error's dependency in panel data models because of common shocks and unobserved components that ultimately become part of the error term, spatial dependence, and idiosyncratic pairwise dependence in the disturbances with no particular pattern of common components or spatial dependence (De Hoyos & Sarafidis, 2006). In an economic sense, cross-sectional dependence in the errors terms can be explained, for instance, as an economic integration in groups of countries, which is the case of Euro-Mediterranean region. In such case, there is probably, strong interdependencies between cross-sectional units.

In a standard panel-data model, under the null hypothesis H_0, errors are assumed to be independent and identically distributed over periods and across cross-sectional units. Under the alternative H_1, errors may be correlated across cross sections, but the assumption of no serial correlation remains (De Hoyos & Sarafidis, 2006).

Thus, the statistical test is:

$$H_0: r_{ij} = r_{ji} = 0 \text{ for } i \neq j$$
$$\text{versus}$$
$$H_1: r_{ij} = r_{ji} \neq 0 \text{ for at least one pair of } i \neq j \quad (6)$$

Where r_{ij} is the product-moment correlation coefficient of the errors.

In this study, three cross-sectional tests are fulfilled. In what follow, a short description is given for each one.

4.1.1. Pesaran's CD test

In a SUR regression, Breusch and Pagan (1980) proposed the following Lagrange multiplier (LM) test statistic (which is valid for fixed N as T $\rightarrow\infty$):

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} r_{ij}^2 \quad (7)$$

Where r_{ij} is the correlation coefficient between errors from individual OLS regression. *LM* is asymptotically distributed as Chi-square with $N(N-1)/2$ degrees of freedom under the null hypothesis of interest (Greene, 2003).

Unfortunately, in some situations, it is not surprising to have a set of data characterized by a large *N* and a finite *T*. Because the *LM* statistic is not adapted to this case, Pesaran (2004) has proposed a new test for $N \rightarrow\infty$ and *T* sufficiently large:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} r_{ij} \right) \quad (8)$$

Unlike the *LM* statistic, the CD statistic has a mean at exactly zero for fixed values of *T* and *N* (De Hoyos & Sarafidis, 2006).

4.1.2. Friedman's test

Based on the average Spearman's correlation coefficient, Friedman (1937) proposed a non-parametric test where the correlation coefficient is the regular product-moment correlation coefficient:

$$R_{AVE} = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} r_{ij} \qquad (9)$$

4.1.3. Frees' test

According to Frees, the CD and R_{ave} suffer from a common drawback; both involve the sum of the pairwise correlation coefficients of the residual matrix rather than the sum of the squared correlations used in the *LM* test (De Hoyos & Sarafidis, 2006). Therefore, these tests are likely to miss cases of cross-sectional dependence when the sign of the correlations is alternating (multiple positive and negative correlations in the residuals). Frees (1995) proposed a statistic that is not subject to this drawback, based on the on the sum of the squared rank correlation coefficients:

$$R_{AVE}^2 = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} r_{ij}^2 \qquad (10)$$

In the following table, tests of cross-sectional dependency are presented:

Table 1. Cross-sectional dependence & heterogeneity tests

Tests of cross-sectional dependence in the SUR system	
Pesaran's CD test	85.707***, (Pr = 0.0000)
Friedman's test	700.616***, (Pr = 0.0000)
Frees' test	11.278***, (Pr = 0.0000)
Tests of cross-country heterogeneity	
lnGDP as dependent variable	
Wald's test	27.63***, Prob > chi2 = 0.0000
Swamy's test	39323.49***, Prob > chi2 = 0.0000
lnHHI as dependent variable	
Wald's test	36.98***, Prob > chi2 = 0.0000
Swamy's test	20603.17***, Prob > chi2 = 0.0000

As it is showed in table 1, all cross-sectional tests strongly reject the null hypothesis of no cross-sectional dependence. As it should be expected from the highly significant results of the CD test, both Friedman's and Frees' tests strongly reject the null of cross-sectional independence. Therefore, there is enough evidence suggesting the presence of cross-sectional dependence between the Euro-Mediterranean countries when considering economic diversification and growth.

In the following, this result will be corroborated by performing slope homogeneity tests. When the cross section dimension *N* is relatively small and the time series dimension of the panel *T* large, the hypothesis of slope homogeneity can be tested using the SUR systems (Zellner, 1962).

Testing for the cross-country heterogeneity is another necessary step in bootstrapping panel Granger-causality approach. The objective is to determine if whether slope coefficients are homogeneous or not.

In this sense, two common tests can be used. Both are developed by Pesaran and Yamagata (2008). The principal is the same. A simple question to ask is whether the panel-specific slopes differ significantly each one from one another:

$$H_0: \beta_i = \beta_j = \cdots = \beta_N \text{ for } i \neq j$$
$$\text{versus}$$
$$H_1: \beta_i \neq \beta_j \neq \cdots \beta_N \quad \text{for at least one pair of } i \neq j \qquad (11)$$

The first test is the Wald test where the F-statistic is asymptotically distributed as Chi-square with N-1 degree of freedom (Pesaran & Yamagata, 2008). Similar to the Wald test, Swamy's (1970) approach develops the slope homogeneity test that allows for cross-section heteroskedasticity (Pesaran & Yamagata, 2008).

The Wald test is defined by:

$$Wald_F = \left[\frac{N(T-k-1)}{k(N-1)}\right]\left(\frac{RSSR-USSR}{USSR}\right) \qquad (12)$$

Where RSSR and USSR are restricted and unrestricted residual sum of squares, respectively, obtained under the null and the alternative hypotheses. Wald test is applicable when the regressors are strictly exogenous and the error variances homoscedastic.

Like the Wald F-test, Swamy's test is developed for panels where *N* is small relative to *T*, but allows for cross section heteroskedasticity. It can be expressed as:

$$\hat{S} = \sum_{i=1}^{N} (\hat{\beta}_i - \hat{\beta}_{WFE})' \frac{X_i' M_\tau X_i}{\hat{\sigma}_i^2} (\hat{\beta}_i - \hat{\beta}_{WFE}) \qquad 13)$$

Where:

$$\hat{\sigma}_i^2 = \frac{(y_i - X_i\hat{\beta}_i)' M_\tau (y_i - X_i\hat{\beta}_i)}{(T-k-1)} \qquad (14)$$

And $\hat{\beta}_{WFE}$ is the Weighted Fixed Effect (WFE) pooled estimator of slope coefficients defined by Pesaran & Yamagata (2008):

$$\hat{\beta}_{WFE} = \left(\sum_{i=1}^{N} \frac{X_i' M_\tau X_i}{\hat{\sigma}_i^2}\right)^{-1} \sum_{i=1}^{N} \frac{X_i' M_\tau y_i}{\hat{\sigma}_i^2} \qquad (15)$$

Then, the standardized dispersion statistic is developed as:

$$\hat{\Delta} = \frac{\hat{S} - NK}{\sqrt{2NK}} \qquad N \rightarrow (0,1) \qquad (16)$$

With $N \rightarrow \infty, T \rightarrow \infty \text{ and } \frac{\sqrt{N}}{T} \rightarrow 0$

According to Pesaran & Yamagata (2008), by centering and standardizing the test-statistic, inference can be carried out by resorting to the standard normal distribution, provided the time dimension is sufficiently large relative to the cross-sectional dimension. Then, a modified version is proposed, namely the adjusted statistic under normally distributed errors:

$$\tilde{\Delta}_{adj} = \sqrt{N(T+1)}\left(\frac{N^{-1}\tilde{S} - K}{\sqrt{2K(T-K-1)}}\right) \qquad (17)$$

Where $\tilde{S}$ is computed as $\hat{S}$ but replacing $\hat{\sigma}_i^2$ by the variance estimator.

Pesaran & Yamagata (2008) argue that both Wald and Swamy's tests are particularly valid for panel's data with relatively small cross-sectional dimension *N* in comparison to a larger time dimension *T*. Moreover, the explanatory variables are strictly exogenous and the error variances are homoscedastic.

The conclusion with respect to the previous table is the existence of a strong heterogeneity between slopes in the SUR regression model between Euro-Mediterranean counties. The results show that there is enough evidence to reject the null hypothesis of cross-sectional homogeneity.

The rejection of slope homogeneity implies that the direction of the causal linkages between economic diversification and growth may differ across the Euro-Med countries.

4.2. Granger Causality Analysis

In testing Granger-causality in panel data, it is assumed that all the entities (Euro-Mediterranean countries) are simultaneously considered so as to allow for contemporaneous correlation across countries, and thereafter test for Granger-causality from lnHHI to lnGDP and from lnGDP to lnHHI performing Wald tests with country specific bootstrap critical values.

In the relevant literature, there is three approaches that have been used to analyze the Granger-causality in panel data. The elementary one is the Vector Error Correction (VEC) in a panel data based on the generalized method of moments (GMM) estimator.

The Kónya's (2006) approach is very relevant, because it is the only one in which both the cross-sectional dependence and the cross-sectional homogeneity/heterogeneity. Moreover, this approach does not require any pre-testing for panel unit root and co-integration. This is the reason why most works use it as a reference one, and this paper is not an exception.

In what follows, the two causality direction results are exposed in order to understand the relationship between economic diversification and growth in the Euro-Mediterranean region. In tables 1 and 2, significant Wald-test of the Granger-causality are in bold character and the t-test column shows also the sign of the causal relationship.

Table 1. H0: lnHHI does not Granger-cause lnGDP (1 lag of lnGDP & 2 lags of lnHHI).

Country	t-test	Wald-test		Bootstrapped p-value	Bootstrap critical values		
					1%	5%	10%
Austria	-5.56563	30.97625	***	0.0000	7.3517	3.9917	2.8175
Belgium	3.843594	14.77322	***	0.0007	7.8264	4.2675	2.9602
Bulgaria	-5.34306	28.54828	***	0.0000	7.8154	4.2601	2.9732
Cyprus	3.538325	12.51974	***	0.0016	7.5224	4.2831	2.9390
Denmark	3.135997	9.83448	***	0.0032	7.4115	4.2010	2.8495
Finland	-0.95226	0.906791		0.3484	7.9659	4.2150	1.3768
France	1.467398	2.153256		0.1561	7.2188	4.2714	2.9229
Germany	2.331556	5.436155	**	0.0257	7.2794	4.1114	2.8354
Greece	5.299233	28.08188	***	0.0000	7.7262	4.2475	2.9451
Ireland	-2.71611	7.377237	**	0.0108	7.4446	4.2942	2.9885
Italy	8.057673	64.92609	***	0.0000	7.6640	4.2669	2.9668
Luxembourg	0.842991	0.710633		0.3985	7.3108	4.1254	2.8012
Malta	1.611581	2.597194		0.1229	7.8140	4.2307	2.9588
Netherlands	0.916739	0.840411		0.3721	7.0484	4.1533	2.8939
Portugal	-1.66314	2.766033		0.1035	6.8999	4.0316	2.8255
Spain	3.693668	13.64318	***	0.0011	7.6662	4.3022	2.9390
Sweden	3.642031	13.26439	***	0.0010	7.3607	4.1584	2.9007
United Kingdom	-0.19734	0.038943		0.8503	7.5489	4.1016	2.7864
Algeria	-1.95511	3.822471	*	0.0651	7.9272	4.4061	3.0261
Egypt	0.008344	6.96E-05		0.9934	7.7050	4.3074	3.0012
Israel	1.540799	2.374061		0.1338	7.5208	4.1710	2.8609
Jordan	-3.4519	11.91561	***	0.0017	8.1050	4.4410	2.9948
Lebanon	-2.55153	6.510278	**	0.0155	7.3497	4.0867	2.8117
Libya	-6.11613	37.40709	***	0.0000	7.4161	4.1391	2.8551
Morocco	1.96629	3.866295	*	0.0588	7.9413	4.2017	2.8576
Syrian Arab Republic	2.475502	6.128108	**	0.0183	7.6730	4.2059	2.8338
Tunisia	0.968865	0.938699		0.3427	7.9857	4.2329	2.8677
Turkey	-1.05555	1.114179		0.3044	7.4682	4.2902	2.9894
Bahrain	1.512458	2.287529		0.1402	7.1912	4.0993	2.8935
Kuwait	0.708761	0.502343		0.4847	7.3275	4.2112	2.9313
Oman	0.536988	0.288356		0.5994	8.0880	4.2107	2.8972
Qatar	0.404266	0.163431		0.6972	7.7299	4.2086	2.9395
Saudi Arabia	-0.75999	0.577584		0.4634	7.9654	4.3493	3.0079
Unites Arab Emirates	6.523307	42.55353	***	0.0000	7.6166	4.1430	2.8465
Palestine	-0.05041	0.002541		0.9574	8.6056	4.4744	2.9930

Note: *****, ** and * indicate significance at the 1%, 5% and 10% levels, respectively**.

4.2.1 Causality from lnHHI to lnGDP

The results of the bootstrapped Granger-causality from lnHHI to lnGDP are reported in table 2. It shows that the null hypothesis (lnHHI does not Granger-cause lnGDP) is rejected for 18 Euro-Med countries against 17 other Euro-Med countries where the null hypothesis is accepted. Therefore, economic diversification positively Granger-cause growth in Belgium, Cyprus, Denmark, Germany, Greece, Italy, Spain, Sweden, Morocco, Syrian Arab Republic and United Arab Emirates; and negatively in Austria, Bulgaria, Ireland, Algeria, Jordan, Lebanon and Libya.

As for the remaining 17 countries, economic diversification does not appear as a determinant factor in growth. Results show that there is no evidence that economic diversification contributes in enhancing growth level in the following countries: Finland, France, Luxembourg, Malta, Netherlands, Portugal, United Kingdom, Egypt, Israel, Tunisia, Turkey, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and Palestine.

Table 2. H0: lnGDP does not Granger-cause lnHHI (4 lags of lnGDP & 1 lag of lnHHI).

Country	t-test	Wald-test		Bootstrapped p-value	Bootstrap critical values		
					1%	5%	10%
Austria	-5.26407	27.710396	***	0.0000	7.3119	4.0575	2.7871
Belgium	-2.12451	4.513561	**	0.0300	6.3979	3.7785	2.7736
Bulgaria	-1.26859	1.609325		0.2123	7.2926	4.0977	2.8199
Cyprus	-3.37098	11.363515	***	0.0013	7.0815	4.0409	2.8611
Denmark	-3.37385	11.382857	***	0.0017	7.1887	4.0232	2.8245
Finland	-4.05039	16.40567	***	0.0004	7.6827	4.2403	2.9389
France	-3.42272	11.715031	***	0.0005	6.2199	3.8183	2.8076
Germany	-2.66382	7.09595	***	0.0076	6.6211	3.8828	2.8213
Greece	-1.7991	3.236756	*	0.0825	7.2859	4.2036	2.8982
Ireland	1.953061	3.814448	*	0.0587	6.9363	4.0612	2.8614
Italy	1.771884	3.139574	*	0.0873	6.8738	4.1019	1.4057
Luxembourg	4.04514	16.363157	***	0.0000	7.0243	3.9982	2.7984
Malta	1.941274	3.768544	*	0.0538	6.8171	3.8941	2.8000
Netherlands	2.802904	7.856272	***	0.0024	5.5073	3.5012	2.5665
Portugal	1.818442	3.306733	*	0.0697	6.0876	3.7211	2.7436
Spain	1.779312	3.165951	*	0.0861	6.9603	4.1286	2.8943
Sweden	8.400435	70.5673	***	0.0000	7.1791	4.2016	2.9142
United Kingdom	3.19319	10.196462	***	0.0032	7.6858	4.2012	2.8949
Algeria	1.766548	3.120691	*	0.0762	6.7779	3.8450	2.6632
Egypt	1.227474	1.506692		0.2127	6.3421	3.6850	2.5630
Israel	2.398609	5.753325	**	0.0201	7.4240	4.0868	2.8171
Jordan	1.360741	1.851617		0.1807	6.5823	3.9339	2.7624
Lebanon	2.806157	7.874516	***	0.0021	6.0593	3.9037	2.7889
Libya	1.335159	1.78265		0.1934	7.5807	4.1379	2.9102
Morocco	-2.05567	4.225766	**	0.0253	5.6763	3.3416	2.4493
Syrian Arab Republic	1.978117	3.912948	**	0.0487	6.9636	3.8683	2.6471
Tunisia	1.524945	2.325458		0.1297	5.9033	3.6681	2.7023
Turkey	-0.52127	0.271721		0.6776	5.4260	3.2141	2.4751
Bahrain	0.746132	0.556714		0.4783	6.3344	3.8959	2.8479
Kuwait	2.141906	4.587761	**	0.0305	6.1869	3.8679	2.7143
Oman	-1.35352	1.832025		0.1830	6.7597	3.9902	2.7990
Qatar	-1.51164	2.28506		0.1415	6.2517	3.7561	2.7611
Saudi Arabia	1.109885	1.231844		0.2748	7.2452	4.0949	2.8784
Unites Arab Emirates	3.133161	9.8167	***	0.0032	7.7296	4.1489	2.8864
Palestine	1.732878	1.002865		0.2523	6.8312	4.0741	2.8536

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

4.2.2. Causality from lnGDP to lnHHI

The Granger-causality from growth to economic diversification is presented in table 3 that indicates the existence of a positive Granger-causal relationship from lnGDP to lnHHI in Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Sweden, United Kingdom, Algeria, Israel, Lebanon, Syria Arab Republic, Kuwait and United Arab Emirates. A negative Granger-Causal relationship from lnGDP to lnHHI is validated in: Austria, Belgium, Cyprus Denmark, Finland, France, Germany, Greece, and Morocco.

The null hypothesis is accepted in the case of Bulgaria, Egypt, Jordan, Libya, Tunisia, Turkey, Bahrain, Oman, Qatar, Saudi Arabia, and Palestine.

4.2.3. Bi-directional causality

Before talking about the bi-directional Granger-causality, it should be mentioned that the evidence of economic diversification Granger-causing growth (18 countries) is validated at the 1% significance level in 12 cases, at the 5% significance level in 4 cases, and finally at 10% significance level in 2 cases. In parallel, the situation in the hypothesis of Growth Granger-cause economic diversification (24 countries) is slightly different, with only 11 validated cases at 1% significance level, 5 cases at 5% significance level, and 7 cases at 10% significance level (see table 3).

A bi-directional Granger-causality is recorded in 15 countries: Austria, Belgium, Cyprus, Denmark, Germany, Greece, Ireland, Italy, Spain, Sweden, Algeria, Lebanon, Morocco, Syria Arab republic, and United Arab Emirates.

Table 3. Cases of Granger-causality in Euro-Mediterranean countries

	Economic diversification Granger-cause growth			Growth Granger-cause economic diversification		
	Positive	Negative	Total	Positive	Negative	Total
1% significance level	8	4	12	6	6	12
5% significance level	2	2	4	3	2	5
10% significance level	1	1	2	6	1	7
Total	11	7	18	15	9	24

For more details, the following summary table (table 4) shows all the obtained results about the bootstrapped Granger-causality tests in all the in-sample countries.

Three main findings can be discussed in this paper. *First*, in Euro-Mediterranean countries, the hypothesis of a Granger-causal impact of growth on economic diversification prevails on the other one that claims a Granger-causal impact of economic diversification on growth.

Table 4. Correlation signs and significance levels in Wald-statistics.

Country	Economic diversification Granger-cause growth	Growth Granger-cause economic diversification
Austria	- (***)	- (***)
Belgium	+ (***)	- (**)
Bulgaria	- (***)	
Cyprus	+ (***)	- (***)
Denmark	+ (***)	- (***)
Finland		- (***)
France		- (***)
Germany	+ (**)	- (***)
Greece	+ (***)	- (*)
Ireland	- (**)	+ (*)
Italy	+ (***)	+ (*)
Luxembourg		+ (***)
Malta		+ (*)
Netherlands		+ (***)
Portugal		+ (*)
Spain	+ (***)	+ (*)
Sweden	+ (***)	+ (***)
United Kingdom		+ (***)
Algeria	- (*)	+ (*)
Egypt		
Israel		+ (**)
Jordan	- (***)	
Lebanon	- (**)	+ (***)
Libya	- (***)	
Morocco	+ (*)	- (**)
Syrian Arab Republic	+ (**)	+ (**)
Tunisia		
Turkey		
Bahrain		
Kuwait		+ (**)
Oman		
Qatar		
Saudi Arabia		
Unites Arab Emirates	+ (***)	+ (***)
Palestine		

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

This means that more enhanced levels of growth generate more diversified economies, for almost the whole Euro-Mediterranean countries, as long as results about 15 countries show a positive Granger-causal relationship from growth to economic diversification.

positive alternative hypothesis, even at the 1% significance level, in the case of Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Sweden, and United Kingdom. In the other 11 cases, statistics suggest the non-causal relationship between growth and economic diversity in Bulgaria, Egypt, Jordan, Tunisia, Turkey, Bahrain, Oman, Qatar, Saudi Arabia, and Palestine.

Furthermore, in the case of Granger-causality from economic diversification to growth, it can be concludes that this hypothesis is less plausible in the Euro-Mediterranean context, because there is about the half of the in-sample countries where there is no statistical evidence of a substantial impact of economic diversification on growth levels. Therefore, the null hypothesis is accepted in the case of Finland, France, Luxembourg, Malta, Netherlands, Portugal, United Kingdom, Egypt, Israel, Tunisia, Turkey, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and Palestine.

A very interesting result shows that, overall, it is difficult to reach an economic integration in the Euro-Mediterranean region, because of the existence of heterogeneous groups of countries. For instance, European Free Trade Association, Central European, North Africa, and Gulf Cooperation Council. In fact, many countries in Euro-Mediterranean area are either advanced economies with high level of diversification or less developed economies with a big concentration on few economic sectors, or even single-sector economies, like crude oil and natural gas.

Third, in Euro-Mediterranean area, there are many countries characterized by relatively low-incomes level. More specifically, countries situated in the North Africa and in Persian Gulf. From another hand, income inequalities are a crucial element in assessing economic integration and income convergence processes. For this reason, it would be helpful to address a mapping plan of incomes distribution as far as economic growth and economic diversification are concerned. In this context, it is about exposing what countries or groups of countries are closer to each other in terms of growth and economic diversification.

To classify countries into the category of high-growth and low-growth, the average of annual GDP is calculated for each country for the period 1975-2013 and then the poverty line is calculated as 2/3 of the median of GDP. Countries having a GDP level higher than the 2/3 median GDP are identified as high-growth or developed countries and countries with a GDP level less than 2/3 the median are classified as low-growth or developing countries. Moreover, the HHI average is calculated in order to point out the countries' position expressed as a relative measure for the economic diversification. The following graph shows, at the same time, countries' position with regard to the poverty line (horizontal reference line), and also their position as regard the average of the diversification index (vertical reference line).

At first glance, the idea that comes to mind is that south-south cooperation is quite possible to achieve with the exchange of resources, technology, and knowledge between developing countries. This is the case of the right-down quadrant, where one can find a set of Euro-Mediterranean countries with a growth level below the poverty line and less diversified economies.

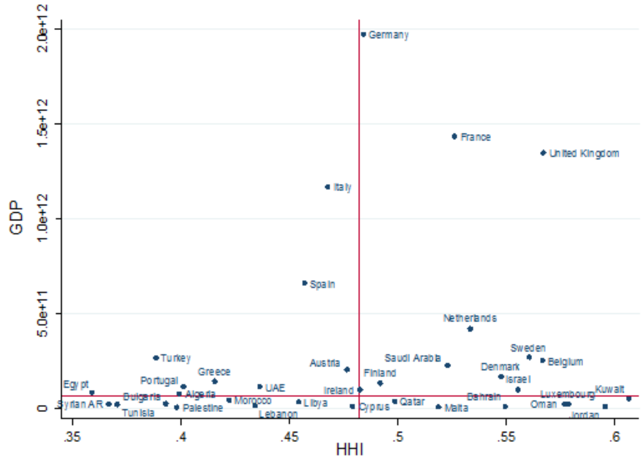

Figure 1. Economic diversification and growth in Euro-Mediterranean countries.

This does not prevent to notice that some countries are in an uncomfortable situation in terms of growth and economic diversification (Jordan, Oman, and Bahrain). Moreover, in the graph, there is another critical situation. Obviously, there is a significant gap between some European countries and other countries situated outside Europe. This means that the north-south cooperation places greater emphasis on closing the evident gap between rich (more economically developed) and poor (less economically developed) countries. Hence, economic diversification and growth are good measures to analyze the current existing gap. The nearer the HHI is to 1, the greater is the country's level of concentration and the further the country is far away from its diversification and growth pathways.

Despite being geographically close to each other, it is difficult to anticipate an accelerated cooperation process in the Euro-Mediterranean area, because of a too far forward step recorded in some countries like Germany, United Kingdom, France, Italy, Netherlands and Spain. At the same time, even if some geographically southern countries are previously considered as developing countries, such as Turkey, and are today more close to the most developed countries, they are still classified inconsistently as developing countries in the graph.

5. Concluding Remarks

This paper studies the possibility of Granger-causality between the economic diversification and growth in 35 Euro-Mediterranean countries from 1975 to 2013. In the empirical analysis, a bootstrapped panel Granger-causality approach based on SUR systems and Wald tests with country specific bootstrap critical values is used, which takes into account both cross-sectional dependence and heterogeneity across countries in order to investigate the relationship between economic diversification and growth.

According to Kónya (2006), the use of this technique is justified by two major advantages. The first one is that the homogeneity in panel data as a primary condition is not fundamentally decisive. Then one can test separately the Granger-causality of each entity in the panel. Moreover, since contemporaneous correlation is allowed across entities, then it is possible to exploit the extra information provided by the panel data setting (Kónya, 2006). The second one is that the analysis can be done without the preliminary tests for unit roots and co-integration suffering from low power in terms of the specification of the lag's structure.

The results indicate that there is a one-way Granger-causality from economic diversification to growth for Bulgaria, Jordan and Libya; and a one-way Granger-causality from growth to economic diversification for Finland, France, Luxembourg, Malta, Netherlands, Portugal, United Kingdom, Israel, and Kuwait. Also, a two-way Granger-causality between economic diversification and growth is found significant in Austria, Belgium, Cyprus, Denmark, Germany, Greece, Ireland, Italy, Spain, Sweden, Algeria, Lebanon, Morocco, Syria, and Unites Arab Emirates, whereas there is no evidence of causality between these variables in Egypt, Tunisia, Turkey, Bahrain, Oman, Qatar, Saudi Arabia, and Palestine.

These findings suggest also that, overall, there is a positive relationship between economic diversification and growth whatever the causality sense. Here, it is important to mention that positive Granger-causality between economic diversification and growth does not necessarily mean that it is the right way to enhance growth levels in Euro-Mediterranean area. The analysis of the signs of the regression coefficients involved in the granger-causality tests is also crucial since the theoretical and empirical frameworks imply some divergence in terms of statements.

Finally, in a comprehensive manner, economic diversification remains a major challenge in Euro-Mediterranean economies through overcoming over-specialization. In a spiral of specialization, which is certainly a source of profits, some Euro-Mediterranean countries are facing the handicap of transferring the know-how to other economic sectors, which currently translates an inability to grabs the opportunities of a proper economic diversification. Furthermore, other factors interact in this perspective, such as trade barriers that exist mainly in countries with low-income's level which can be summarized by a weak competitiveness, inadequate production capacities, a lack access to finance and skilled labor, etc. These are the main challenges that should be addressed in order to reach more enhanced levels of economic integration.

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