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THE RELATIONSHIP BETWEEN GOVERNMENT REVENUES AND EXPENDITURES: BOOTSTRAP PANEL GRANGER CAUSALITY ANALYSIS ON EUROPEAN COUNTRIES

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Abstract
The objective of this paper is to test the relationship between government expenditure and revenue nexus in EU 10 countries during the period 1980-2013. This study uses the panel causality approach proposed by Kónya (2006) that take into account cross section dependency and heterogeneity across countries. The first empirical results point to the "tax-spend hypothesis" for Germany, Italy, and Netherlands. We found government expenditure Granger causes government revenue for France and Portugal, consistent with the "spend-tax hypothesis". But, there is no relationship between these fiscal variables for Austria, Belgium, Denmark, Finland, and UK, pointing support the "institutional separation hypothesis" or "fiscal independence hypothesis". After determining the direction of the causality in a country, government must manage the eligible fiscal policies and they restore the fiscal balance and reduce the public deficits for a sustainable fiscal and economic path.

Keywords: Government revenue, Expenditure, Cross section dependence, Panel causality test

JEL classification: C33, E62, H61, H71

1. Introduction

In the last decades, the relationship between the government revenues (taxes) and expenditure (spending) is analyzed, because of the developing of the public debt and deficits after World War II. Especially, the increasing of public debt and deficits has caused some concerns for policymakers. This relationship between them is also important not only researchers but also policymakers in the matter of balanced budget in the long run. There is a developing body of the literature that examines the relationship between the revenues and spending with different methods. The main point in this study is to understand the effectiveness fiscal policy to reduce government deficits and to determine the behavior of government revenues and government expenditures in relation to how fiscal policy is set-up in the practice.

According to theory of public finance, government revenues and expenditures are supposed to be balanced in the long run. This hypothesis that examines the relationship between government revenues and spending is to importance in terms of the distribution of government resources. Besides, government revenues and spending are also the tools of fiscal policy, the adjustments in the tools of the fiscal policy are crucial to determine the price stability, economic growth, unemployment, investment and capital accumulation. Thus, it requires understanding the relationship between revenues and expenditures with regard to causes and results of budget balance.

In this paper, we offer an empirical testing procedure to discriminate between spending and taxation hypothesis using data for EU (European Union) 10 countries during the period 1980-2013. The determining the fiscal situation within the fragile structure is a major role providing the fiscal balances. In the result of the financial crisis of the EU, the importance of sustainable fiscal policies has been increasing day by day. In order to identify the relationship between government expenditures and revenues is crucial for macroeconomic stability in the framework sustainable budget deficit. The causality relationships between these variables are to test with novel bootstrap panel granger approach.

The paper contributes to the empirical literature by extending the government taxation and spending nexus in EU 10 countries for the period 1980-2013. This study, however, fills the gap in the taxation and spends literature as part of existing literature. Firstly, this is early attempt to test on this causality with a panel of 10 EU countries. Secondly, we use the panel causality approach which takes account of time series and cross sectional dependencies. Panel analysis gives more powerful results than time series analysis and this method is a crucial in a high degree of interdependent for these countries. Thirdly, unlike previous studies, we use a causality test based on panel data approach developed by Kónya (2006) that consider cross section dependency and heterogeneity across countries. It is substantial to determine the cross-section dependence in panel data models because of the presence of common shocks and unobserved components. It has experienced a growing economic and financial integration of countries that indicates strong interdependencies between cross-units (Hoyos and Sarafidis, 2006). The remainder of this paper is organized as follows. Section 2 explains the hypotheses and literature review for this study, section 3 provides the data and methodology used in our study. Section 4 describes the empirical results and finally section 5 concludes the paper.

2. Hypotheses and literature review

There are four main hypotheses about the relationship between government revenues and expenditures in public finance literature. There are four testable hypotheses in the literature, also known as (i) "tax and spend hypothesis", (ii) "spend and tax hypothesis", (iii) "fiscal synchronization hypothesis" and finally, (iv) "institutional separation hypothesis" or "fiscal independence". First of this theory is the "tax-spend hypothesis" proposed by Friedman (1978).

He stated that an increasing amount of government revenues to satisfy the budget deficits causes to increases in government expenditures. Therefore, an increasing in tax revenues will not conduct to lower deficits. Only solution to reducing the budget deficit is to decrease government spending.

Another version of this hypothesis is supposed by Buchanan and Wagner (1977). They claim that a decreasing amount of tax revenues will reduce the government expenditures in the context of fiscal illusion. According to this view, reducing taxes cause to higher expenditure because of perceived as a cheaper the prices of goods and services provided by the public. Hence, negative unidirectional causality running from taxation to spending is also known Buchanan and Wagner hypothesis (Wagner, 1976; Buchanan and Wagner, 1977; Buchanan and Wagner, 1978). *Second* hypothesis is the "spend-tax hypothesis" developed by Peacock and Wiseman (1979) and Roberts (1978). This view supports that transitory government spending will increase after crisis or the war period and then, the changes in government expenditures will cause to higher permanent taxation. In order to finance the government expenditures, government will increase the revenues. If government determines to reduce the expenditures, herewith budget deficits will also be reduced in the end.

As a result, there will be positive unidirectional causality from government expenditure to government revenues. In the framework of this hypothesis, another view is based on the study of Barro (1979). He states that a cut in taxes at present will cause to higher taxes in future as well as same amount. According to Barro (1979), government expenditures are financed with higher taxation in next time and government expenditures lead to changes in taxes. He claims that the reduction in budget balance can be provided by reducing in government spending. This hypothesis is also known the Ricardian equivalence hypothesis at the same time. *Third* hypothesis is "fiscal synchronization hypothesis" set forth by Musgrave (1966) and Meltzer and Richard (1981). However, this hypothesis clarifies that there are simultaneity causality between government revenues and expenditures.

Finally, "the institutional separation hypothesis" or "fiscal independence" indicates that there is no relationship between government revenues and expenditures. This situation shows the independent determination of revenues and expenditures, separately (Wildavsky, 1988; Baghestani and McNown, 1994). Their hypothesis is based that government decision is determined revenues and spending in the form of independence. There are several studies with different methods developed to test whether the revenues determine the spending or spending determines the revenues. In our analysis, we use two types of analyses for this topic with one-country or multi-countries. In this analysis, there are numerous papers with different kind of methods and techniques to determine the relationship between taxation and spending in Table 1 and 2 about EU area. As it can be seen in Table 1 and 2, they summary the empirical studies about tax and spends as a data, methodology and results.

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Table 1: Studies with one-country for revenue and expenditure in the literature

Studies	Period	Country	Methods	Results
Anderson et al. (1986)	1946-1983	US	Granger Causality	$E \rightarrow R$
Manage and Marlow (1986)	1929-1982	US	Granger Causality	$E \leftrightarrow R$
Von Furstenberg et al. (1986)	1954-1982	US	VAR	$E \rightarrow R$
Ram (1986)	1929-1983	US	Granger Causality	$E \rightarrow R$
Blackley (1986)	1929-1982	US	Granger Causality	$R \rightarrow E$
Ahiakpor and Amirkhalkhali (1989)	1926-1985	Canada	Granger Causality	$R \rightarrow E$
Bohn (1991)	1792-1988	US	ECM	$R \rightarrow E$
Baghestani and McNown (1994)	1955-1989	US	ECM	$R \not\leftrightarrow E$
Hondroyiannis and Papapetrou (1996)	1957-1993	Greece	Granger Causality	$E \rightarrow R$
Payne (1997)	1950-1994	Canada	ECM	$R \rightarrow E$
Hasan and Lincoln (1997)	1961-1993	UK	ECM	$R \rightarrow E$
Katrakilidis (1997)	1974-1991	Greece	ECM	$R \leftrightarrow E$
Park (1998)	1964-1992	Korea	Granger Causality	$R \rightarrow E$
Darrat (1998)	1967-1994	Turkey	Granger Causality	$R \rightarrow E$
Li (2001)	1950-1997	China	ECM	$R \leftrightarrow E$
Chang and Cho (2002)	1977-1999	China	MVECM	$R \leftrightarrow E$
Hussain (2004)	1973-2003	Pakistan	Granger Causality	$R \rightarrow E$
Al-Quadir (2005)	1964-2001	Saudi-arabia	ECM	$R \leftrightarrow E$
Young (2009)	1955-2005	US	Granger Causality	$R \rightarrow E$
Zapf and Payne (2009)	1959-2005	US	ECM	$E \rightarrow R$
Saunoris and Payne (2010)	1955-2009	UK	ECM	$E \rightarrow R$
Apergis, Payne and Saunoris (2012)	1957-2009	Greece	TAR	$R \rightarrow E$
Richter and Dimitrios (2013)	1833-2009	Greece	Granger Causality	$E \rightarrow R$
Aworinde (2013)	1961-2012	Nigeria	Granger Causality	$R \rightarrow E$

Note: R denotes government revenue, E shows government expenditure, $\rightarrow$ indicates unidirectional causality, $\leftrightarrow$ denotes bidirectional causality, and $\not\leftrightarrow$ notes no causality between R and E.

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Table 2: Studies with multi-countries for revenue and expenditure nexus in the literature

Studies	Period	Country	Methods	Results
Owoye (1995)	1961-1990	G7 Countries	ECM	E↔R : US, Germany, UK, France, Canada R→E : Japan, Italy
Payne (1998)	1942-1992	47 US States	Engle-Granger ECM	R→E: 24 states E→R: 8 states R↔E: 11 states
Chang, Liu and Caudill (2002)	1951-1996	10 Industrialized Countries	Granger Causality	R→E: Japan, S. Korea, Taiwan, UK, US E→R: Australia and S. Africa R↔E: Canada R↮E:New Zealand, Thailand
Narayan and Narayan (2006)	1950-2000	12 Developing Countries	Granger Causality	R→E: Mauritius, El Salvador, Haiti, Chile Venezuela E→R: Haiti R↔E: Peru, South Africa, Guatemala, Uruguay, Ecuador
Afonso and Rault (2009)	1960-2006	EU-25	Panel Causality	E→R: Italy, France, Spain, Greece, and Portugal R→E: Germany, Belgium, Austria, Finland, UK
Westerlund, Mahdavi and Firoozi (2011)	1963-1997	50 US state-local government	Cointegrati on	R→E
Paleologou (2013)	1965-2009	Greece, Sweden, Germany	TAR, MTAR	R→E: Greece R↔E: Sweden, Germany

Note: R denotes government revenue, E shows government expenditure, → indicates unidirectional causality, ↔ denotes bidirectional causality, and ↮ signifies no causality between R and E.

3. Data and Methodology

The purpose of this paper is to test whether there is a relationship between government revenue and expenditure by using panel Granger causality analysis by Kónya (2006) during the period from 1980 to 2013. All data used in this study are taken from the *AMECO* (Annual Macroeconomic Database of the European Commission's) for EU 10 countries. The following panels are used: EU10 (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, and United Kingdom). These countries have been selected according to the data availability. In this analysis, we use government revenue and expenditure data as a ratio of GDP and it is important to scale the real variables for the panel method except for the fact that ratios of nominal sizes which are mostly used in most papers.

In addition, we do not require panel unit root methods in order to analyze the bootstrap panel causality test. To test the cross-sectional dependence and slope homogeneity is also important step in selecting in a appropriate panel causality. Before analyzing the panel causality procedure, we test to that there is cross-sectional dependence and heterogeneity for these countries in the panel causality.

3.1. Cross-Section dependence tests

It is substantial to determine the cross-section dependence in panel data models because of the presence of common shocks and unobserved components. In the last decades, we have experienced a growing economic and financial integration of countries and financial entities that indicates strong interdependencies between cross-units (Hoyos and Sarafidis, 2006). Testing the cross-section dependence, we can apply *LM* test statistics using the Breusch and Pagan (1980) and Pesaran (2004). The Breusch and Pagan (1980) Lagrange Multiplier (*LM*) test is built upon the sum of squared coefficients of correlation among cross-section residuals acquired by ordinary least squares (OLS). The *LM* test statistic is under the null hypothesis of no cross-section correlations and has a fixed *N* and $T \rightarrow \infty$. The *LM* test is distributed as chi-square asymptotic $N(N-1)/2$ degrees of freedom and this test is practical for large *T*. The test statistics can be calculated as follows:

$$LM = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^{2} \qquad (1)$$

where $\hat{\rho}_{ij}^{2}$ is the sample estimation of pair-wise correlation coefficients gained from OLS (ordinary least squares) estimation for each *i*. Generally, LM test is offered for panels with small *N* and large *T*. But, in a panel where $T \rightarrow \infty$ and $N \rightarrow \infty$, Pesaran (2004) developed CD_{lm} test which is the scaled version of *LM* test. Therefore, this test is not suitable with large N. In order to solve this problem, it can be used Lagrange multiplier statistic developed by Pesaran (2004). The test statistics can be shown as follows:

$$CD_{lm} = \sqrt{\frac{1}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T\hat{\rho}_{ij}^{2}-1) \qquad (2)$$

CD_{lm} has the asymptotic standard normal distribution with first $T \rightarrow \infty$ and then $N \rightarrow \infty$ under the null hypothesis. When *N* is large and *T* is small, it is used CD test which allows the cross-section dependence proposed by Pesaran (2004). It is based on the sum of the coefficients of correlation among cross-section residuals. The new test is calculated below:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \tag{3}$$

Pesaran (2004) states that the CD test has mean zero for fixed values T and N which include heterogeneous dynamic models subject to multiple breaks in slope coefficients and error variances. Thus, the unconditional means of y_{it} and x_{it} is time-invariant and they are symmetrically distributed. Thus, CD test will lack power in certain situations where the population average pair-wise correlations are zero, but yet the underlying individual population pair-wise correlations are non-zero (Pesaran et al., 2008: 106). Under the assumption for first $T \to \infty$ and then $N \to \infty$, Pesaran et al. (2008, 108) suggest bias-adjusted test ($\mathrm{LM}_{\mathrm{adj}}$) of modified versions of the LM tests which is the exact mean and variance of the LM statistic for the panel data models. $\mathrm{LM}_{\mathrm{adj}}$ has exactly mean zero, unlike LM test and it has asymptotic standard normal distribution with first $T \to \infty$ and then $N \to \infty$ under the null hypothesis. According to Pesaran et al. (2008), $\mathrm{LM}_{\mathrm{adj}}$ is not as robust as the CD test to non-normal errors and/or in the presence of weakly exogenous regressors (Pesaran, 2004: 106). The bias-adjusted test ($\mathrm{LM}_{\mathrm{adj}}$) proposed Pesaran et al. (2008) is:

$$\mathrm{LM}_{\mathrm{adj}} = \sqrt{\left(\frac{2}{N(N-1)}\right)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\frac{(\mathrm{T}-\mathrm{k})\hat{\rho}_{ij}^{2}-\mu_{Tij}}{\upsilon_{Tij}} \tag{4}$$

where $\hat{\rho}_{ij}$ is the sample estimate of the pair-wise correlation of the residuals, k is the number of regressors, μ_{Tij} and υ_{Tij} are the exact mean and variance of $(\mathrm{T}-\mathrm{k})\hat{\rho}_{ij}^{2}$, respectively (Pesaran et al., 2008: 108).

3.2. Slope Homogeneity Tests

It is important to decide whether or not slope coefficients are homogeneity or heterogeneous for a panel causality analysis. Generally, it is supposed that the slope coefficients of interest in panel data models are homogeneous across individual units in many empirical studies (Pesaran and Yamagata, 2008: 50). The null hypothesis of slope homogeneity they supposed is $H_0 : \beta_i = \beta$ for all i and alternative hypothesis which is determined $H_1 : \beta_i \neq \beta_j$ for a non-zero fraction of pairwise slopes for $i \neq j$. The first type test is based on Swamy (1970) which is applicable to panel data models. Swamy test statistic is to compute using the pooled FE, rather than the ordinary least squares estimator. This test is valid for a fixed N and as $T \to \infty$. Swamy (1970) determined the slope homogeneity on the dispersion of individual slope estimates from a suitable pooled estimator. This test is developed for

N is small relative to *T,* though it allows the cross section heteroskedasticity (Pesaran and Yamagata, 2008: 54-55). The Swamy test for slope homogeneity is follow:

$$\tilde{S} = \sum_{i=1}^{N}\left(\hat{\beta}_i - \hat{\beta}_{WFE}\right)' \frac{X_i' M_\tau X_i}{\hat{\sigma}_i^2}\left(\hat{\beta}_i - \hat{\beta}_{WFE}\right) \qquad (5)$$

where $\hat{\beta}_i$ is the pooled OLS estimator, M_τ is an identity matrix of order *T,* $\tilde{\sigma}_i^2$ is the choice of the estimator of σ_i^2, $\hat{\beta}_{WFE}$ is the weighted FE (WFE) pooled estimator of slope coefficients. A Test of slope homogeneity based on $\tilde{\Delta}$ is likely to have better size properties than the tests based on $\tilde{\Delta}$. The version of the dispersion test statistic in this case is follow:

$$\tilde{\Delta} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - k}{\sqrt{2k}}\right) \qquad (6)$$

$\tilde{\Delta}_{adj}$ has the correct size for all combination of sample sizes, when T is very small relative to N and it also seems to have reasonable power properties. The small sample properties of the $\tilde{\Delta}$ test can be developed under the normally distributed errors by in view of the following mean and variance bias adjusted version as follow:

$$\tilde{\Delta}_{adj} = \sqrt{N}\left(\frac{N^{-1}\tilde{S} - E(\hat{z}_{iT})}{\sqrt{Var(\hat{z}_{iT})}}\right) \qquad (7)$$

3.2. Panel bootstrap causality test

We analyze EU-27 countries using the bootstrap causality approach of Kónya (2006)[1] which is based on both cross-sectional dependency and country-specific homogeneity. Causality tests in literature are a concept in use and it generally mentions the ability of one variable to predict or cause the other (Asteriou and Hall, 2007). In the panel data set, the Granger-causality should take into account for the cross-sectional dependency and heterogeneity across countries. Granger (1969) causality approach demonstrated that the question of whether X causes Y is to determine and knowledge of past values of X helps to determine the forecasts of Y. If two series are co-integrated, it must be tested to determine the direction of causality among the variables. Once determining for the cross-sectional dependence and country-specific heterogeneity, we can apply bootstrap causality approach proposed by Kónya (2006) which take into account both cross-sectional dependency and homogeneity in our context to general revenue *R,* and general expenditure *E.* Panel bootstrap

[1] We are grateful to L. Kónya for sending his TSP codes we used in our analysis.

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granger causality test is based on seemingly unrelated regressions (SUR) and Wald tests with country specific bootstrap critical values for detecting causal relationships in the panel (Kónya, 2006: 979).

This method has some advantages. *Firstly*, this procedure does not require pre-testing the unit root and cointegration properties of the variables used in their levels. Therefore, the variables in the system do not need to be stationary in this analysis. *Secondly*, because contemporaneous correlation is allowed in across countries, it makes possible to use the extra information provided by the panel data setting. Thus, these set of equations are not VAR, but SUR systems. *Thirdly*, there is no need for pre-testing except for the specification of the lag structure. In addition, this approach identify how many and which countries exists one way or granger causal relation (Kónya, 2006: 979-981). The procedure is based on estimating first following equations:

$$\begin{aligned} R_{1,t} &= a_{1,1} + \sum_{l=1}^{ly1} \beta_{1,1,l} R_{1,t-l} + \sum_{l=1}^{lx1} \partial_{1,1,l} E_{1,t-l} + \xi_{1,1,t} \\ R_{2,t} &= a_{1,2} + \sum_{l=1}^{ly1} \beta_{1,2,l} R_{2,t-l} + \sum_{l=1}^{lx1} \partial_{1,2,l} E_{2,t-l} + \xi_{1,2,t} \\ &\vdots \\ R_{N,t} &= a_{1,N} + \sum_{l=1}^{ly1} \beta_{1,N,l} R_{N,t-l} + \sum_{l=1}^{lx1} \partial_{1,N,l} E_{N,t-l} + \xi_{1,N,t} \end{aligned} \quad (8)$$

and

$$\begin{aligned} E_{1,t} &= a_{2,1} + \sum_{l=1}^{ly2} \beta_{2,1,l} R_{2,t-l} + \sum_{l=1}^{lx2} \partial_{2,1,l} E_{1,t-l} + \xi_{2,1,t} \\ E_{2,t} &= a_{2,2} + \sum_{l=1}^{ly2} \beta_{2,2,l} R_{2,t-l} + \sum_{l=1}^{lx2} \partial_{2,2,l} E_{2,t-l} + \xi_{2,2,t} \\ &\vdots \\ E_{N,t} &= a_{2,N} + \sum_{l=1}^{ly2} \beta_{2,N,l} R_{N,t-l} + \sum_{l=1}^{lx2} \partial_{2,N,l} E_{N,t-l} + \xi_{2,N,t} \end{aligned} \quad (9)$$

where R denotes the government revenue, E refers to the government expenditure, index i refers to the country ($i = 1,...,N$), index t is the period ($t = 1,...,N$), l is the lag length, $ly1$ and $lx1$ are the maximal lags for R and E in the first set of equations, and finally $ly2$ and $lx2$ are the maximal lags for R and E in the second set of equations. The error terms, $\xi_{1,1,t}$, $\xi_{1,2,t}$, $\xi_{2,1,t}$, $\xi_{2,2,t}$, are supposed to be white-noises (Kónya, 2006: 980).

Concerning this system, one can find alternative causal relations for a country: (i) there is one-way Granger-causality from E to R if not all $\partial_{1,i}$ are zero, but all $\beta_{2,i}$ are zero, (ii) there is one-way Granger causality running from R to E if all $\partial_{1,i}$ are zero, but not all $\beta_{2,i}$ are zero, (iii) there is two-way Granger causality between E and R if neither $\delta_{1,i}$ nor $\beta_{2,i}$ are zero, and (iv) there is no Granger causality between E and R if all $\partial_{1,i}$ and $\beta_{2,i}$ are zero (Kónya, 2006: 981).

Given that the results from the causality test might be sensitive to the lag structure, one need to very careful in determining the optimal lag length(s) in order to reach the valid and reliable results. Therefore, before we proceed for estimation and testing for direction of Granger-causality, one need to determine carefully the optimum number of lags. The crucial step is the determination of appropriate lag structure because the causality test results may depend critically on it. Specifically, choice of both too few and too many lags may result in problems. If too few lags are chosen, it may cause to omission of some important variables from the model. Especially, if too many lags are chosen for the observations in the model, this situation will improve the standard errors for the estimated coefficients. Thus, the results obtained from this selection may result bias in the retained regression and less precise decisions. If it is chosen the lag structure which is allowed to vary across countries for a relatively large panel, this situation would enhance the computational burden substantially. To cope with this problem, Kónya (2006) proposed to allow different maximal lags for R and E in each system, but to be the same across equations. Therefore, it is used four maximal lag parameters, assuming from 1 to 4, and we determine eq. (8) and (9) for each possible pair of $ly1, lx1, ly2,$ and $lx2$, respectively. After determine the each possible pair of them, we choose the combinations minimized the Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC) (Kónya, 2006: 982-983).

4. Empirical results

In a panel causality analysis, it is crucial to determine the cross-sectional dependence and slope homogeneity in a panel causality analysis. We have experienced a growing economic and financial integration of countries and financial entities that indicates strong interdependencies between cross-units (Hoyos and Sarafidis, 2006). It is important to take account of cross-sectional dependency and country-specific heterogeneity in empirical analysis, because countries have a high degree of globalization in terms of economic relations. In Table 3, it is shown the results of cross-sectional dependence and slope homogeneity tests. Before we test the panel causality tests, empirical study starts to analyze the existence of cross-sectional dependency and heterogeneity across the countries. In order to test the cross-section dependence, we can perform four different cross-sectional dependence tests, named LM, CD_{lm}, CD, LM_{adj} developed by Breusch and Pagan (1980), Pesaran (2004), and Pesaran et al. (2008).

The cross-sectional dependency refers that examining causal linkages between government revenue and expenditure in ten EU countries require in the light of this information in estimations of causality regressions. In cross-sectional dependence tests, it is used Zellner's (1962) seemingly unrelated regression equation (SURE) method and it is more effective than country specific OLS estimation method. The results indicate that the null hypothesis of no cross-sectional dependence is rejected at 1% level of significance and it provides strong evidence on the existence of the cross-sectional dependency across the EU countries. So, these results signify that a shock in an EU country can be transferred easily to any country in the EU countries. Table 3 also demonstrates the results of slope homogeneity tests. We reject the null hypothesis of the slope homogeneity test and we support the country specific heterogeneity.

Table 3: Results of Cross-Sectional Dependence and Homogeneity Test

Tests	Test Statistics	P-values
LM	343.142***	0.000
CD_{LM}	31.427***	0.000
CD	17.229***	0.000
LM_{adj}	31.262***	0.000
$\tilde{\Delta}$	8.329***	0.000
$\tilde{\Delta}_{adj}$	8.849***	0.000

Note: While the null hypothesis has no cross-section dependence, alternative hypothesis assumes the cross-section dependence. *** indicates rejection of the null hypothesis at 1 % level of significance. The data for these tests include during the period 1980-2013.

Table 4: Results of Panel Causality Test

Countries	H_0 : Exp does not cause Rev				H_0 : Rev does not cause Exp			
	Wald Stat.	Bootstrap critical values			Wald Stat.	Bootstrap critical values		
		1%	5%	10%		1%	5%	10%
Austria	0.734	13.353	7.916	5.359	3.409	17.987	9.522	6.217
Belgium	0.008	12.555	7.399	4.837	1.204	13.915	7.787	5.234
Denmark	0.823	14.377	7.862	5.340	0.266	14.295	8.389	5.399
Finland	3.562	13.342	6.897	4.533	2.723	11.859	6.672	4.514
France	15.247***	10.721	6.733	4.814	0.045	13.136	7.388	5.298
Germany	1.683	13.450	7.153	4.829	6.337*	15.546	8.662	6.021
Italy	2.954	12.017	6.929	4.636	16.014***	14.453	8.589	5.764
Netherlands	1.201	12.884	6.392	4.578	10.261**	15.446	9.058	5.651
Portugal	18.022***	15.245	7.811	5.098	2.556	16.036	9.569	6.519
UK	1.851	14.259	7.184	5.118	0.368	15.859	7.780	5.622

Note: Bootstrap critical values were obtained from 10.000 replications. ***, **, and * imply rejection of the null hypothesis at the 1%, 5% and 10% levels of significance, respectively.

Table 4 shows the results of the Panel Granger causality test for the EU 10 panel during the period 1980-2013. Test findings obtained from the causality show that there is a unidirectional causality from government expenditure to revenue in the France and Portugal at 1% level of significance. The null hypothesis of non-causality running from government expenditure to revenue cannot be rejected on behalf of France and Portugal. In addition, other test results also show that there is one-way

Granger causality runs from government revenue to expenditure in Germany, Italy, and Netherlands at the 10%, 1% and 5% levels of significance, respectively. With regard to other countries, there is no causality both expenditure to revenue and revenue to expenditure between them. This means that there is no relationship between government revenues and expenditures, pointing the "institutional separation hypothesis" or "fiscal independence" for these countries namely, Austria, Belgium, Denmark, Finland, and UK. Determining the relationship between expenditure and revenue, it is important signal for the fiscal policy and fiscal situation in the EU countries and these findings will affect the sustainability of fiscal balance in terms of economic stability and growth.

5. Conclusion

This paper set out to test the existence of causality relationship between government revenue and expenditure nexus in EU 10 countries for the period 1980-2013. We used the bootstrap causality method of Kónya (2006) based on both cross-sectional dependency and country-spesific homogeneity in this study. According to these results, we derived some different results stemming from these empirical findings. *First,* test results point to the "tax-spend hypothesis" for Germany, Italy, and Netherlands proposed by Friedman (1978). *Second,* we found some findings for France and Portugal government expenditure Granger causes government revenue, consistent with the "spend-tax hypothesis" developed by Peacock and Wiseman (1979) and Roberts (1978). *Third,* we do not find bidirectional causality between government revenue and expenditure for these countries. *Fourth,* there is no relationship both from government revenues to government expenditure or vice versa even at the 10% significance level for 5 EU countries, namely Austria, Belgium, Denmark, Finland, and UK. This means that these countries are independent in terms of government revenue and expenditure decisions, pointing support the "institutional separation hypothesis" or "fiscal independence hypothesis".

To determine the relationship between government revenue and expenditure is crucial for most countries in the way of both persistent deficits and to sustainable fiscal policies and budget balance. These results show how the country can conduct its budget balance and fiscal policy in the next time using the government fiscal performance. According to the results, government should balance the government expenditure and revenue decisions and make a point of fiscal adjustments for a balanced budget balance. If governments determine the direction of the causality in a country, they can effectively manage the fiscal imbalances. The government should regulate their economic policies which will restore fiscal balance and reduce the public deficits without reducing social expenditure for a sustainable fiscal path.

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