

**PUBLIC DEBT, ECONOMIC OPENNESS,
AND SUSTAINABLE ECONOMIC GROWTH IN EUROPE:
A DYNAMIC PANEL CAUSAL ANALYSIS**

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This paper examines the short-term and long-term dynamics between public sector debt, economic openness, and economic growth in European countries between 1990 and 2018. Using the panel vector error correction model, we find that both public debt and economic openness contribute to long-term economic growth in European countries. The empirical analysis also shows that there are strong endogenous links between public debt, economic openness and economic growth in Europe in the short run. These relationships suggest that governments in Europe should give careful attention to the co-curation of macroeconomic policies pertaining to public sector spending/taxation, economic openness, and economic growth.

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1. INTRODUCTION

Public debt¹ often represents the financial status of a nation. It may be linked to a number of variables such as household savings and may ultimately have an impact on

¹ Public debt is defined as the liabilities of the government against domestic residents compared to foreign residents and which require the payment of principal and interest that are unconditional (IMF, 2003).

the long-term economic growth of a nation² (Jacobs et al., 2019; Toktaş et al., 2019; Arai et al., 2018). The relationship between public debt and economic activity has received considerable attention in the literature. However, the debate has not resulted in conclusive answers. This is because fiscal measures undertaken by governments have a major impact on the accumulation of public debt and aggregate demand – both of which have an impact on economic growth.

It is reasonable to assume that public debt and economic growth are also impacted by the degree of economic openness of countries.³ In this paper, we argue that the direction of causal relationships between public debt and economic growth, taking into consideration the degree of economic openness, is rather complex. For example, in a more open economic environment, competition for input resources (including foreign direct investment) and markets are more intense. To move up the global innovation value chain and sustain economic growth, governments tend to invest in building resilient national innovation and business ecosystems. These include spending on resources to build the necessary physical infrastructure (roads, ports and other amenities), digital infrastructure, education, research and development (R&D) and efficient institutions of governance. A vibrant national innovation ecosystem is critical for spawning new discoveries, innovations and technologies that will enhance the competitiveness of domestic firms and stimulate economic growth.

The other factor that impacts public debt is the stage the economies are in the business cycle. Most governments tend to follow a counter-cyclical macroeconomic policy measure, where during a boom (high economic growth), governments reduce public sector funding (subsidies) and increase tax collection. These measures tend to reduce public debt. On the other hand, during a recession, governments tend to increase public expenditure on major infrastructure projects, unemployment insurance schemes and other cash transfer measures to increase disposable income with the hope of increasing domestic consumption and economic growth. In some countries, the increase in public sector spending may not elevate consumption during a recessionary period. Hence, it may not increase economic growth. This is since economic agents may increase savings to ensure they have adequate basic resources during the down cycle of the economy. Many of them also may increase saving in anticipation of increase the future tax burden due to the deficit position of the country. Hence, the impact of public

² The theoretical justifications of the impact of public debt on economic growth began with the work of Keynes who claimed that public debt contributes significantly to economic growth particularly in developing countries because of the larger role the government often plays in these economies (see, for instance, Toktaş et al., 2019; Dombi and Dedák, 2019; Cecchetti et al., 2010).

³ Economic openness in this context is defined as level of trade openness, that is the level of imports and exports within an economy. Another measure used to capture the level of economic openness is the inflow of foreign direct investment into an economy. As will become apparent, this paper, unlike most others in the literature, uses both measures of economic openness.

spending on economic growth can be mixed (see, for instance, Mhlaba and Phiri (2019), OECD (2018), Moga et al. (2016), Saint-Paul (1992)).

The above discussions show that the inter-relationships between public debt, economic openness and economic growth are rather complex. In this paper, we plan to reveal the complexities by examining the short-term and long-term causal relationships between these variables using the Granger-Causality test for European economies.⁴ Over the last two decades, there has been a lacklustre economic growth rate in many European economies. There have been a wide range of factors to explain this phenomenon, which include the following: increased competition from major economic players from Asia and North America; political and economic uncertainties in many economies in Europe; and more recently BREXIT – the imminent departure of the United Kingdom from the European Union.

The economic uncertainties in Europe and increased public spending by countries in Asia and North America on developing dynamic and vibrant national innovation ecosystems have had a major impact on Europe in attracting high-quality foreign direct investment (FDI). Many of the cities in Europe struggled to attract the much needed FDIs to upgrade their industrial ecosystems, build strong supply networks and nurture next-generation pace-setting firms. Large multinational companies (MNCs) also tend to gravitate to localities with state-of-the-art infrastructure and technology, easy access to creative talent, effective governance systems and a vibrant supply of innovative start-up firms. A recent survey shows that only London and Berlin are among the top ten cities that are regarded as important test-bed for producing the next technology leaders (Ernst and Young, 2019). The top leading cities are San Francisco and Silicon Valley and out of the 10 cities, 6 are from Asia (Ernst and Young, 2019).

Thus, the primary focus of the present study is to examine the short-run and long-run dynamics between public debt, economic openness (trade openness and FDI) and economic growth in Europe. These results will provide valuable insights into the types of macroeconomic policies pertaining to public sector spending and economic openness policies that countries in Europe should pursue to achieve sustained economic growth.

Five notable contributions are made in this study. First, the findings provide insight into the causal interactions between public debt and economic growth, between economic openness and economic growth, and between public debt and economic openness. Results from other studies on the *bilateral* relationship between these variables have been inconclusive. Second, combining three strands of the literature in order to examine the simultaneous relationship between *all three* covariates (public debt, economic growth, and degree of economic openness) is another key contribution of this study. Third, thus far, there has not been sufficient research into the endogenous link between these variables, which our study supplies through its careful examination of four hypotheses (the supply-leading, demand-following, feedback, and neutrality-hypotheses) linking each variable to another. Fourth, existing studies focus mostly on

⁴ The discussion of causality in this paper considers causality in a temporal sense.

trade openness as a proxy for the degree of *economic* openness of a country. In contrast to earlier work, we consider not only trade openness, but also foreign direct investment (FDI) as a measure of economic openness. Fifth, through examining the dynamics between public debt, economic openness, and economic growth and from our analytical results, we can offer prescriptions to policymakers on the right combination of policies pertaining to these variables in both the short run and the long run.

The balance of this paper is organised as follows: In Section 2, a summary of the background research and hypothesis formulation is offered. In Section 3, the empirical methodology is outlined. In Section 4, a discussion of the results is presented. In Section 5, policy implications and concluding remarks are given.

2. BACKGROUND LITERATURE AND HYPOTHESIS FORMULATION

There are three research standpoints in the literature on the relationship between economic openness, public debt, and economic growth. These relationships are linked to the channels through which public debt can affect economic growth either positively or negatively (Dombi and Dedák, 2019; Grobety, 2018; Panizza and Presbitero, 2013; Vaicekauskas and Lakstutiene, 2012). One such channel is economic openness, particularly through trade openness and foreign direct investment (see, for instance, Toktaş et al. (2019)), as outlined in Figure 1.

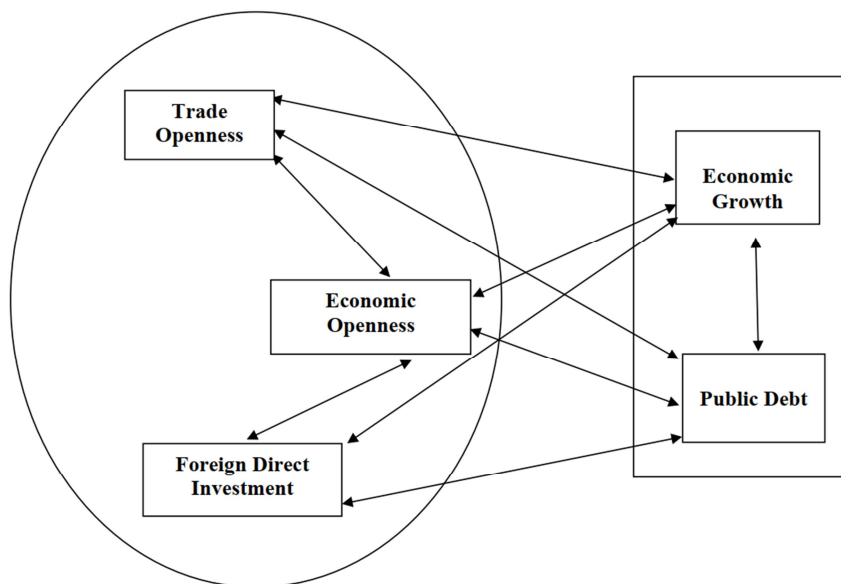


Figure 1: The Conceptual Framework on the Possible Causal Relations between Economic Openness, Public Debt, and Economic Growth

The first strand of literature focuses on the public debt and economic growth nexus. As mentioned earlier, government spending on productive endeavours such as providing better physical infrastructure (roads, ports and other amenities), digital infrastructure, education, funding for research and development and development of good institutions can have a positive impact by creating new employment opportunities, instilling greater efficiency in the public sector, and enhancing the productivity of the corporate sector; all of which can raise economic growth. This hypothesis is called the '*debt-led-growth hypothesis*'. Studies that support this hypothesis include Jacobs et al. (2019); Gomez-Puig and Sosvilla-Rivero (2018a, b), and Pradhan et al. (2016a, b).

On the other hand, increased economic activities will result in an increase in the wealth of a country. As income levels increase, the demand (by consumers and firms) for better public facilities and support services will increase; this will raise the public debt level. This hypothesis is called the '*growth-led-debt hypothesis*'. Studies that support this hypothesis include Saungweme and Odhiambo (2019). There have been also studies that have shown that public debt and economic growth will reinforce one another (Ncanywa and Masoga, 2018; Gomez-Puig and Sosvilla-Rivero, 2018; Ferreira, 2009). Thus, the following null hypothesis is tested in the present paper:

$H^A_{1, 2}$: *Public debt does not Granger-cause per capita economic growth and vice versa.*

The second strand of literature focuses on the economic openness and economic growth nexus. This relationship has been extensively studied in the literature. The first relationship is captured by the "*openness-led growth hypothesis*," which suggests that as the economic openness increases, it stimulates economic growth. The rationale for this line of argument is that a more open economy will increase foreign direct investment, which will result in several spill-over effects such as an increase in technology-and knowledge-transfers and inflow of capital and other much-needed resources that will contribute to economic growth. An increase in trade flows between countries will also increase economic activities and employment opportunities, which will enhance economic growth. Studies that support this causal relationship include Bojanic (2012), Yavari and Mohseni (2012), Kumar and Pacheco (2012), Chowdhury and Mavrotas (2006), Alfaro et al. (2004).

Several studies have also shown that economic growth can lead to economic openness, known as the "*growth-led-openness hypothesis*." Proponents supporting this hypothesis argue that as nations increase their economic growth, they would have access to the much-needed capital to build technological and innovative capabilities. Well-developed technological capabilities will enable countries to be part of the global production and supply networks – thus, fostering greater economic integration with other countries. Studies that support this hypothesis include Shahbaz (2012), Bajwa and Siddiqi (2011), Konya (2006), Reizman et al. (1996). Other studies have also shown that economic openness and economic growth can mutually reinforce each other – thus

suggesting the validity of the feedback hypothesis (Awokuse, 2007; Din, 2004; Xu, 1996; Pradhan et al., 2017; Pradhan et al., 2019; Pradhan et al., 2020). Based on the above discussion, the following null hypothesis is tested in the present study:

$H_{1,2}^B$: *Economic openness does not Granger-cause per capita economic growth and vice versa.*

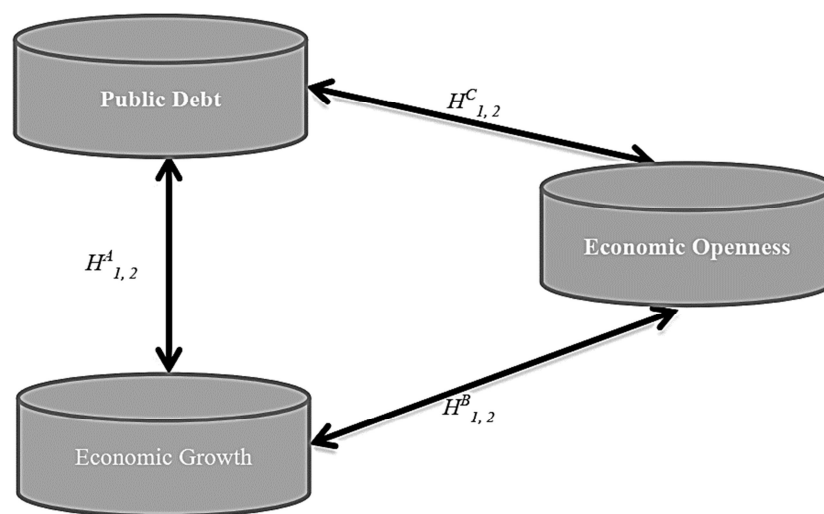
The third strand of literature focuses on the economic openness and public debt nexus. The first hypothesis examined is the “*openness-led- public debt hypothesis*”, which suggests that economic openness contributes to public sector debt. The rationale for this line of argument is that increased economic openness can lead to a higher inflow of foreign direct investment and trade in a country to support the development of the necessary infrastructure, technology, expertise and other resources to create employment and support economic development. This may lead to a reduction in government burden to provide support for the various national development initiatives and other welfare support schemes.

Increased economic openness can also intensify competition within the domestic economy. Thus, to raise the competitiveness level of local firms, governments may be required to increase spending to strengthen domestic innovation and business ecosystems. These include providing good education and skills training for the workforce, R&D funding for universities and research centres of excellence, increasing access to high-quality research and testing facilities for the corporate sector, and providing affordable ICT infrastructure and other services to enhance the competitiveness of the local players. These development initiatives will increase the public sector debt of the economies.

There have also been studies that have examined the impact of public debt on economic openness – summarized under the “*public debt-led-openness*” hypothesis. The rationale for this hypothesis is that increasing public spending, especially on key elements that enhance the competitiveness of the domestic economic agents would enable them to extend their market reach to a wider segment of the global market. Further, countries that can develop globally competitive industries tend to pursue bilateral and multilateral trade liberalization policies to ensure that their firms have deep and extensive global market reach. These governments also put in place enough incentives to attract high-quality investments into their countries to strengthen their domestic industrial ecosystems. Many of these highly competitive firms, especially the MNCs have been active in establishing factories and manufacturing plants in countries with strong and dynamic national innovation ecosystems, thus increasing the flow of FDIs across the globe. There have been also studies that have shown that public debt and economic openness reinforce one another. The causal relationships between public debt and economic openness have been examined in Onafowora and Owoye (2019), Edquist and Henrekson (2017), Bolanle and Fapet (2015). Thus, the following null hypothesis is tested in the present paper:

$H_{1,2}^C$: Public debt does not Granger-cause economic openness and vice versa.

To the best of our knowledge, no other study simultaneously considers the three variables (public debt, economic openness, and economic growth) in the same framework for the group of countries studied in the present paper. In this study, we examine both the long-run and short-run Granger causal relationships between the three variables for European countries using the panel vector error-correction model (PVECM). A summary of the causal relationship is outlined in Figure 2.



Notes: If the null hypotheses are rejected, causality is indicated by the directional arrows that are shown.

Figure 2. Possible Causal Relationships between Economic Openness, Public Debt, and Per Capita Economic Growth

3. EMPIRICAL METHODOLOGY

In this section, we outline the data and the empirical methodology that is used in this study to capture the short-run and long-run dynamics between the public debt, economic openness and economic growth.

Annual data on the variables were obtained from *World Development Indicators* published by the World Bank for a panel of 52 European countries⁵, spanning the period 1990-2018. The variables used are real per capita economic growth (PEG), economic

⁵ Countries comprise 10 eastern European, 17 northern Europe, 16 southern Europe, and 9 western Europe countries.

openness (EOP), and public debt (PUD). This study considers the full sample of 52 European countries, as well as three sub-samples covering different European country grouping: the European Economic Area (EEA)⁶, the Eurozone⁷, and the European Single Market Economy (SEM).⁸ Within each of the four samples, we set up two *structures*, each structure considers a different measure of economic openness. Our first measure is the degree of trade openness (OPE); our second measure is the inflow of FDI. Both these are expressed as a percentage of gross domestic product (GDP). Furthermore, within each structure, we examine two *cases*. Each case utilizes a different indicator of public debt, namely public debt as a percentage of GDP (DGR) and per capita public debt (PCD). All monetary variables are expressed in constant US dollars.

In this study, we postulate that both public debt and economic openness can have important impacts on economic growth. All the variables in the empirical model are expressed in natural logarithmic form in order to normalize the data. The equation relating the variables may be written as follows:

$$PEG_{it} = \beta_0 + \beta_1 t + \beta_{2i} PUD_{it} + \beta_{3i} EOP_{it} + \xi_{it}, \quad (1)$$

where t denotes time, i refers to the country, and the last term is the error term. Of course, theoretically, other variables (PUD or EOP) may serve as the dependent variable. This is entertained in our estimating Equation (2) presented below.

We start by performing a cross-sectional dependence test, a unit root test, and a cointegration test among the variables. We first deploy the cross-sectional dependence (CD) test proposed by Pesaran (2004). Next, we perform the cross-sectional augmented IPS (CIPS) unit root test developed by Pesaran (2007) to determine the existence of the cross-sectional dependency and the order of integration of the variables in our panel setting.⁹ Finally, we use the Pedroni (2004) panel cointegration test to assess the presence of cointegration across the variables under study.¹⁰

In addition, we deploy the fully modified ordinary least squares (FMOLS) proposed by Pedroni (2004) and the dynamic ordinary least squares (DOLS) proposed by Kao and

⁶ These are Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, and the United Kingdom.

⁷ These cover Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.

⁸ These include Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

⁹ The CD test confirms the existence of the cross-sectional dependence in all the four panels, while the CIPS test confirms that all the variables under investigation are integrated of order one, i.e., $I(1)$.

¹⁰ This confirms the existence of a long-run equilibrium relationship between variables in our four samples in each structure and each case.

Chiang (2001) and Mark and Sul (2003) to estimate the long-run relationship between these variables. Both FMOLS and DOLS are effective because they take explicitly into account the endogeneity of regressors and they correct for serial correlation.¹¹

The estimates from these tests and from FMOLS/DOLS are not reported here due to space constraints. However, the results are available from the authors on request.

Based on the inference of unit root and cointegration among these variables, we use the following PVECM as the estimating model for determining the direction of causality between them:

$$\begin{bmatrix} \Delta \ln PEG_{it} \\ \Delta \ln PUD_{it} \\ \Delta \ln EOP_{it} \end{bmatrix} = \begin{bmatrix} \rho_{1j} \\ \rho_{2j} \\ \rho_{3j} \end{bmatrix} + \sum_{k=1}^q \begin{bmatrix} \alpha_{11ik} & \alpha_{12ik} & \alpha_{13ik} \\ \alpha_{21ik} & \alpha_{22ik} & \alpha_{23ik} \\ \alpha_{31ik} & \alpha_{32ik} & \alpha_{33ik} \end{bmatrix} \begin{bmatrix} \Delta \ln PEG_{it-k} \\ \Delta \ln PUD_{it-k} \\ \Delta \ln EOP_{it-k} \end{bmatrix} + \begin{bmatrix} \lambda_{1i} \\ \lambda_{2i} \\ \lambda_{3i} \end{bmatrix} ECT_{it-1} + \begin{bmatrix} \xi_{1it} \\ \xi_{2it} \\ \xi_{3it} \end{bmatrix}, \quad (2)$$

where ECT_{it-1} is the lagged error-correction term resulting from the cointegrating vector, ξ is the error term, and i and t represent the country and time specifications respectively in the panel. For illustration, public debt Granger causes economic growth if $\alpha_{12ik} \neq 0$, while $\alpha_{21ik} = 0$, suggests that economic growth Granger causes public debt. Similarly, if all [$\alpha_{12ik} \neq 0$ and $\alpha_{21ik} = 0$, $\alpha_{13ik} \neq 0$ and $\alpha_{31ik} = 0$, and $\alpha_{23ik} \neq 0$ and $\alpha_{32ik} = 0$] are statistically different, this suggests that these three variables Granger cause each other.

4. EMPIRICAL RESULTS AND DISCUSSION

In this section, we report the short-run and long-run causal relationships between public debt, economic openness, and economic growth for the European countries. Table 1 presents the results for the four *samples* and the two *structures* and two *cases* within each sample.

We first report the long-run estimates, ascertained by examining the statistical significance of the ECT_{it-1} coefficients. Table 1 shows that for economic growth as a dependent variable, the estimates are statistically significant at the 1% level. This implies that economic growth tends to converge to its long-run equilibrium path in response to changes in public debt and economic openness. This relationship holds for all the four *cases* under each *structure* and each *sample* that we consider. Therefore, the overall conclusion is that per capita economic growth in European countries is significantly influenced by both public debt and economic openness in the long term.

¹¹ Both FMOLS and DOLS estimates document that all the coefficients are statistically significant, demonstrating that economic growth is associated with both public debt and economic openness.

In the short run, however, the results are mostly non-uniform. In the first sample (for the panel of all European countries), the common finding is bidirectional causality between public debt and economic growth (see Sample 1 in Table 1). This bidirectional causality is consistent with the findings of Ncanywa and Masoga (2018) and Gomez-Puig and Sosvilla-Rivero (2018). Additionally, we find bidirectional causality between trade openness and economic growth and trade openness and public debt for both *Case 1* and *Case 2* under *Structure 1*. Moreover, we find unidirectional causality from foreign direct investment to both economic growth and public debt for both *Case 1* and *Case 2* under *Structure 2*.

In the second sample (for the panel of the European Economic Area countries), the common finding is unidirectional causality from public debt to economic openness. This was true for both trade openness and foreign direct investment (see Sample 2 in Table 1). This unidirectional causality is consistent with the findings of the recent studies by Onafowora and Owoye (2019), Mhlaba and Phiri (2019), Senibi et al. (2017), Yong et al. (2017), Moga et al. (2016), and Oche et al. (2016). Additionally, we find the unidirectional causality from trade openness to economic growth and from public debt to economic growth for *Case 1* and *Case 2* under *Structure 1*. Moreover, we find bidirectional causality between public debt and economic growth and foreign direct investment and economic growth for both *Case 1* and *Case 2* under *Structure 2*.

In the third sample (for the panel of Eurozone countries), the general finding is the unidirectional Granger causality from public debt to economic growth (see Sample 3 in Table 1). This unidirectional causality is consistent with the findings of recent studies by Toktaş et al. (2019), Gomez-Puig and Sosvilla-Rivero (2018), and Saint-Paul (1992). Additionally, we find the unidirectional causality from economic growth to trade openness and from public debt to trade openness for *Case 1* and *Case 2* under *Structure 1*. Moreover, we find bidirectional causality between public debt and foreign direct investment and foreign direct investment and economic growth for both *Case 1* and *Case 2* under *Structure 2*.

In the fourth sample (for the panel of the European Single Market Economy), the common finding is bidirectional causality between public debt and economic growth (see Sample 4 in Table 1). This bidirectional causality is consistent with the findings of studies by De Vita et al. (2018) and Gomez-Puig and Sosvilla-Rivero (2018). Additionally, we find a unidirectional causality from trade openness to economic growth and from public debt to trade openness for *Case 1* and *Case 2* under *Structure 1*. Moreover, we find bidirectional causality between foreign direct investment and economic growth and unidirectional causality from foreign direct investment to public debt for both *Case 1* and *Case 2* under *Structure 2*.

In summary, there are important temporal causal links between the variables in the short run and a robust uniform long-run result across all samples, structures, and cases suggesting that public debt and economic openness are key in propelling the long-term economic growth rate of European countries.

Table 1. Results of Panel Granger Causality Test

Dependent Variable	Independent variable and ECT_{-1}									
	Case 1					Case 2				
	ΔPEG	ΔOPE	ΔDGR	ECT_{-1}	SR Inference	ΔPEG	ΔOPE	ΔPCD	ECT_{-1}	SR Inference
Sample 1: European Countries										
Structure 1: PEG, OPE, PUD										
ΔPEG		5.11**	13.3*	-0.75*	$OPE \leftrightarrow PEG$		5.31**	17.9*	-0.62*	$OPE \leftrightarrow PEG$
ΔOPE	6.34*		7.04*	-0.03	$DGR \leftrightarrow PEG$	6.91*		4.80***	-0.10	$PCD \leftrightarrow PEG$
ΔPUD	5.51**	6.89*		-0.38	$OPE \leftrightarrow DGR$	11.7*	8.61*		-0.85	$OPE \leftrightarrow PCD$
Structure 2: PEG, FDI, PUD										
	ΔPEG	ΔFDI	ΔDGR	ECT_{-1}	SR Inference	ΔPEG	ΔFDI	ΔPCD	ECT_{-1}	SR Inference
ΔPEG		14.0*	8.72*	-0.46*	$FDI \rightarrow PEG$		13.6*	12.6*	-0.47*	$FDI \rightarrow PEG$
ΔFDI	3.23		0.81	-0.25	$DGR \leftrightarrow PEG$	2.61		1.48	-0.08	$PCD \leftrightarrow PEG$
ΔPUD	9.55*	5.83**		-0.55	$FDI \rightarrow DGR$	10.1*	9.99*		-0.44	$FDI \rightarrow PCD$
Sample 2: E/A Countries										
Structure 1: PEG, OPE, PUD										
	ΔPEG	ΔOPE	ΔDGR	ECT_{-1}	SR Inference	ΔPEG	ΔOPE	ΔPCD	ECT_{-1}	SR Inference
ΔPEG		5.61**	7.82*	-0.84*	$OPE \rightarrow PEG$		4.95***	14.3*	-0.55*	$OPE \rightarrow PEG$
ΔOPE	0.34		5.55**	-0.01	$DGR \rightarrow PEG$	1.10		7.38*	-0.02	$PCD \rightarrow PEG$
ΔPUD	3.96	0.08		-0.01	$OPE \leftarrow DGR$	1.61	0.59		-0.10	$OPE \leftarrow PCD$
Structure 2: PEG, FDI, PUD										
	ΔPEG	ΔFDI	ΔDGR	ECT_{-1}	SR Inference	ΔPEG	ΔFDI	ΔPCD	ECT_{-1}	SR Inference
ΔPEG		5.29**	20.5*	-0.84*	$FDI \leftrightarrow PEG$		9.89*	17.4*	-0.55*	$FDI \leftrightarrow PEG$
ΔFDI	7.74*		9.85*	-0.01	$DGR \leftrightarrow PEG$	5.33**		5.22**	-0.02	$PCD \leftrightarrow PEG$
ΔPUD	8.19*	1.52		-0.01	$FDI \leftarrow DGR$	6.10*	1.44		-0.10	$FDI \leftarrow PCD$

Notes: PEG: per capita economic growth rate; OPE: trade openness; FDI: foreign direct investment, DGR: debt-GDP ratio; PCD is per capita debt; and ECT_{-1} : error-correction term. PUD denotes public debt and is used for DGR and PCD. *, ** and *** indicate that parameter estimates are significant at the 1%, 5% and 10% levels, respectively. $\leftarrow/\leftrightarrow$ indicate the direction of short-run Granger causality.

Table 1. Results of Panel Granger Causality Test (con't)

Dependent Variable	Independent variable and ECT_{-1}													
	Sample 3: Eurozone Countries					Sample 4: SEM Countries								
Structure 1: PEG, OPE, PUD	Case 1			SR Inference			Case 2			SR Inference				
	Δ PEG	Δ OPE	Δ DGR	ECT_{-1}	$OPE \leftarrow PEG$	$DGR \rightarrow PEG$	$OPE \leftarrow DGR$	Δ PEG	Δ OPE	Δ FDI	Δ PCD	ECT_{-1}	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$
Δ PEG	2.64	11.5*	-0.84*	$OPE \leftarrow PEG$	21.4*	1.12	5.14**	8.35	-0.55*	-0.02	-0.10	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$	$OPE \leftarrow PCD$
Δ OPE	6.60*	4.60***	-0.01	$DGR \rightarrow PEG$	8.35	5.14**	1.07	0.22	-0.02	-0.10	-0.10	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$	$OPE \leftarrow PCD$
Δ PUD	2.42	0.26	-0.01	$OPE \leftarrow DGR$	1.07	0.22	1.07	0.22	-0.02	-0.10	-0.10	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$	$OPE \leftarrow PCD$
Structure 2: PEG, FDI, PUD	Case 1			SR Inference			Case 2			SR Inference				
	Δ PEG	Δ FDI	Δ DGR	ECT_{-1}	$FDI \leftrightarrow PEG$	$DGR \rightarrow PEG$	$FDI \leftrightarrow DGR$	Δ PEG	Δ FDI	Δ PCD	ECT_{-1}	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$	$FDI \leftrightarrow PCD$
Δ PEG	7.26*	5.60**	-0.84*	$FDI \leftrightarrow PEG$	6.53*	8.77*	13.6*	9.75*	-0.55*	-0.02	-0.10	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$	$FDI \leftrightarrow PCD$
Δ FDI	7.93*	9.27*	-0.01	$DGR \rightarrow PEG$	9.75*	8.77*	13.6*	9.75*	-0.55*	-0.02	-0.10	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$	$FDI \leftrightarrow PCD$
Δ PUD	3.16	5.21**	-0.01	$FDI \leftrightarrow DGR$	1.77	4.81***	1.77	4.81***	-0.55*	-0.02	-0.10	$FDI \leftrightarrow PEG$	$PCD \rightarrow PEG$	$FDI \leftrightarrow PCD$
Structure 1: PEG, OPE, PUD	Case 1			SR Inference			Case 2			SR Inference				
	Δ PEG	Δ OPE	Δ DGR	ECT_{-1}	$OPE \rightarrow PEG$	$DGR \leftrightarrow PEG$	$OPE \leftarrow DGR$	Δ PEG	Δ OPE	Δ PCD	ECT_{-1}	$OPE \rightarrow PEG$	$PCD \leftrightarrow PEG$	$OPE \leftarrow PCD$
Δ PEG	5.57**	9.10*	-0.84*	$OPE \rightarrow PEG$	12.3*	5.46**	0.06	5.36**	-0.55*	-0.02	-0.10	$OPE \rightarrow PEG$	$PCD \leftrightarrow PEG$	$OPE \leftarrow PCD$
Δ OPE	0.26	4.92***	-0.01	$DGR \leftrightarrow PEG$	5.36**	5.46**	0.06	5.36**	-0.55*	-0.02	-0.10	$OPE \rightarrow PEG$	$PCD \leftrightarrow PEG$	$OPE \leftarrow PCD$
Δ PUD	5.29*	1.44	-0.01	$OPE \leftarrow DGR$	7.70*	1.23	7.70*	1.23	-0.55*	-0.02	-0.10	$OPE \rightarrow PEG$	$PCD \leftrightarrow PEG$	$OPE \leftarrow PCD$
Structure 2: PEG, FDI, PUD	Case 1			SR Inference			Case 2			SR Inference				
	Δ PEG	Δ FDI	Δ DGR	ECT_{-1}	$FDI \leftrightarrow PEG$	$DGR \leftrightarrow PEG$	$FDI \rightarrow DGR$	Δ PEG	Δ FDI	Δ PCD	ECT_{-1}	$FDI \leftrightarrow PEG$	$PCD \leftrightarrow PEG$	$FDI \rightarrow PCD$
Δ PEG	7.89*	7.93*	-0.84*	$FDI \leftrightarrow PEG$	11.3*	8.93*	6.67*	4.96***	-0.55*	-0.02	-0.10	$FDI \leftrightarrow PEG$	$PCD \leftrightarrow PEG$	$FDI \rightarrow PCD$
Δ FDI	7.02*	3.15	-0.01	$DGR \leftrightarrow PEG$	1.80	8.93*	6.67*	4.96***	-0.55*	-0.02	-0.10	$FDI \leftrightarrow PEG$	$PCD \leftrightarrow PEG$	$FDI \rightarrow PCD$
Δ PUD	5.42**	4.99***	-0.01	$FDI \rightarrow DGR$	7.45*	4.96***	7.45*	4.96***	-0.55*	-0.02	-0.10	$FDI \leftrightarrow PEG$	$PCD \leftrightarrow PEG$	$FDI \rightarrow PCD$

Notes: PEG: per capita economic growth rate; OPE: trade openness; FDI: foreign direct investment, DGR: debt-GDP ratio; PCD is per capita debt; and ECT_{-1} : error-correction term. PUD denotes public debt and is used for DGR and PCD. *, **, and *** indicate that parameter estimates are significant at the 1%, 5% and 10% levels, respectively. \leftarrow / \rightarrow / \leftrightarrow indicate the direction of short-run Granger causality.

5. POLICY IMPLICATIONS AND CONCLUDING REMARKS

The study aims to examine causal relationships between public debt, economic openness, and economic growth – all simultaneously considered – in Europe. This is a continent that has experienced lacklustre economic growth over the last few decades due to political uncertainties and intensive competitive pressure from other regions, notably many countries in North America and Asia.¹²

The empirical analysis finds that the variables are cointegrated, indicating the presence of a long-run equilibrium relationship between them. Most importantly, there is clear evidence that both economic openness and public debt matter in the determination of the long-run economic growth of countries in Europe. The empirical results also suggest that there are strong endogenous relationships between public debt, economic openness and economic development in these economies in the short run.

Our empirical analysis has important policy implications. The short-term and long-term inter-relationships between the variables suggest that policymakers must give careful thought to co-development policies pertaining to public spending/taxation/debt, as well as to economic openness initiatives and other economic growth strategies. Countries in Europe must take a ‘holistic approach’ in ensuring the public sector spending is targeted towards enhancing the productive capacity of firms in Europe. This includes developing key infrastructure (physical and technological) and talent and institutions of governance, including taxation schemes that encourage innovation and entrepreneurial activities (start-ups). These policies are critical for raising the competitiveness of the domestic workforce and industries. Effective public spending policies will enable the corporate sector in Europe to extend its reach to high-quality FDI, talent, technology and markets from other countries within Europe and across the globe. A cohesive policy to build a sound and dynamic regional supplier network for key industries in Europe will go a long way to strengthen Europe’s position in its race to move up the global innovation value chain and complement other regional supplier networks in North America and Asia.

To wit, Germany is one of the most competitive economies in Europe and a global industrial powerhouse for adopting similar prudent policies. Germany put in place a public spending strategy to strengthened its national innovation ecosystem by investing in the following key areas: R&D in frontier and eco-friendly technologies that enhance productivity, efficiency and new sources of economic growth (i.e., R&D in technologies that have the potential to spawn new sources of economic growth); creative talent that harness these technology enablers to create value and economic wealth for all stakeholders in the economy; family benefits and other support services to increase

¹² Considering structural breaks (e.g. the global financial crisis of 2018) would have been an interesting twist to our narrative. However, this was not possible since utilizing a panel causality model with PVECM requires a long span of time. In other words, creating several sub-periods within 1990-2018 would have led to questionable and spurious results.

greater employment among all segments of the population, especially women and families with young children; and tax incentives, including the provision of venture capital and other financial support to enhance entrepreneurial activities (OECD, 2018). The above initiatives have enabled Germany to increase its export performance due to its deeply integrated global value chains, operating at the higher end of the value chain. This has enabled Germany to register a higher GDP performance over the years, compared to many other European and OECD countries (OECD, 2018).

In summary, the empirical evidence suggests that there are strong causal linkages between public debt, economic openness, and economic growth both in the short and long run in Europe. These relationships suggest that co-curation macroeconomic policies pertaining to public sector debt, economic openness, and other growth stimulating initiatives are critical in placing European economies in more sustainable economic growth trajectories.

REFERENCES

- Alfaro, L., A. Chanda, S. Kalemli-Ozcan and S. Sayek (2004), "FDI and Economic Growth: The Role of Local Financial Markets," *Journal of International Economics*, 64(1), 89-112.
- Arai, R., K. Naito and T. Ono (2018), "Intergenerational Policies, Public Debt, and Economic Growth: A Politico-Economic Analysis," *Journal of Public Economics*, 166(C), 39-52.
- Awokuse, T.O. (2007), "Causality Between Exports, Imports and Economic Growth: Evidence from Transition Economies," *Economics Letters*, 94(3), 389-395.
- Bajwa, S. and M.W. Siddiqi (2011), "Trade Openness and Its Effects on Economic Growth in Selected South Asian Countries: A Panel Data Study," *International Journal of Human and Social Sciences*, 6(2), 138-143.
- Bojanic, A.N. (2012), "The Impact of Financial Development and Trade on the Economic Growth of Bolivia," *Journal of Applied Economics*, 15(1), 51-70.
- Bolanle, A. and Fapet, O. (2015), "External Debt or Foreign Direct Investment: Which Has Creator Significant Economic Impact on Nigeria?" *European Scientific Journal*, 11(19), 135-148.
- Cecchetti, G., Mohanty, M. and F. Zampolli (2010), "The Future of Public Debt: Prospects and Implications," BIS Working Paper No. 300, Bank for International Settlements (BIS), Basel.
- Chowdhury, A. and G. Mavrotas (2006), "FDI and Growth: What Causes What," *World Economy*, 29(1), 42-58.

- De Vita, G., E. Trachanas, and Y. Luo (2018), "Revisiting the Bi-Directional Causality Between Debt and Growth: Evidence from Linear and Nonlinear Tests," *Journal of International Money and Finance*, 83, 55-74.
- Din, M (2004), "Exports, Imports, and Economic Growth in South Asia: Evidence Using a Multivariate Time-Series Framework," *Pakistan Development Review*, 43(2), 105-124.
- Dombi, A. and I. Dedák (2019), "Public Debt and Economic Growth: What Do Neoclassical Growth Models Teach Us?" *Applied Economics*, 51(29), 3104-3121.
- Edquist, H. and M. Henrekson (2017), "Swedish Lessons: How Important are ICT and R&D to Economic Growth?" *Structural Change and Economic Dynamics*, 42, 1-12.
- Ernst and Young (EY) (2019), "How Can Europe Raise Its Game?," EY Attractiveness Survey, June.
- Ferreira, C. (2009), "Public Debt and Economic Growth: A Granger Causality Panel Data Approach," Working Paper No. 24, Lisbon: Technical University of Lisbon.
- Gómez-Puig, M. and S. Sosvilla-Rivero (2018a), "On the Time-Varying Nature of The Debt-Growth Nexus: Evidence from the Euro Area," *Applied Economics Letters*, 25(9), 597-600.
- _____ (2018b), "An Investigation of Nonlinear Effects of Debt On Growth," *Journal of Economic Asymmetries*, 18, 1-13.
- Grobéty, M. (2018), "Government Debt and Growth: The Role of Liquidity," *Journal of International Money and Finance*, 83(C), 1-22.
- Jacobs, J., K. Ogawa, E. Sterken and I. Tokutsu (2019), "Public Debt, Economic Growth and the Real Interest Rates: A Panel VAR Approach to EU and OECD Countries," *Applied Economics* (forthcoming).
- Kao, C. and M.H. Chiang (2001), "On the Estimation and Inference of a Cointegrated Regression in Panel Data," in B.H. Baltagi, T.B. Fomby and R.C. Hill (Eds), *Nonstationary Panels, Panel Cointegration, and Dynamic Panels (Advances in Econometrics)*, pp. 179-222, Emerald Group Publishing Limited, Bingley.
- Konya, L. (2006), "Exports and Growth: Granger Causality Analysis on OECD Countries with A Panel Data Approach," *Economic Modeling*, 23(6), 978-992.
- Kumar, S. and G. Pacheco (2012), "What Determines the Long Run Growth Rate in Kenya?" *Journal of Policy Modeling*, 34, 705-718.
- Mark, N. and D. Sul (2003), "Cointegration Vector Estimation by Panel DOLS and Long-run Money Demand," *Oxford Bulletin of Economics and Statistics*, 65(5), 655-680.
- Mhlaba, N. and A. Phiri (2019), "Is Public Debt Harmful Towards Economic Growth? New Evidence from South Africa," *Cogent Economics and Finance*, 7, 1-15.
- Moga, T., H. Jilenga and D. Mathieu (2016), "The Impact of External Debt and Foreign Direct Investment on Economic Growth: Empirical Evidence from Tanzania," *International Journal of Financial Research*, 7(2), 154-162.
- Ncanywa, T. and M.M. Masoga (2018), "Can Public Debt Stimulate Public Investment and Economic Growth in South Africa?" *Cogent Economics and Finance*, 6, 1-13.

- Oche, M.O., G. Mah and I. Mongale (2016), "The Effects of Public Debt on Foreign Direct Investment in South Africa (1983-2013): An Empirical Analysis," *Risk Governance and Control: Financial Markets and Institutions*, 6 (4), 448-456.
- OECD (2018), OECD Economic Survey Report: Germany, June, www.oecd.org/eo/surveys/economic-survey-germany.htm.
- Onafowora, O. and O. Owoye (2019), "Public Debt, Foreign Direct Investment and Economic Growth Dynamics: Empirical Evidence from the Caribbean," *International Journal of Emerging Markets* (forthcoming).
- Panizza, U. and A.F. Presbitero (2014), "Public Debt and Economic Growth: Is There a Causal Effect?" *Journal of Macroeconomics*, 41, 21-41.
- Panizza, U. and A.F. Presbitero (2013), "Public Debt and Economic Growth in Advanced Economies: A Survey," *Swiss Journal of Economics and Statistics*, 149 (2), 175-204.
- Pedroni, P. (2004), "Panel Cointegration; Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to The Purchasing Power Parity Hypothesis," *Econometric Theory*, 20, 597-625.
- Pesaran, M.H. (2004), "General Diagnostic Tests for Cross Section Dependence in Panels," Cambridge Working Papers in Economics No. 0435, University of Cambridge, Cambridge.
- Pesaran, M.H. (2007), "A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence," *Journal of Applied Econometrics*, 22(2), 265-312.
- Pradhan, R.P., M.B. Arvin, N.R. Norman and S. Bahmani (2020), "The Dynamics of Bond Market Development, Stock Market Development and Economic Growth: Evidence from the G-20 Countries," *Journal of Economics, Finance and Administrative Science*, 25(49), 19-147.
- Pradhan, R.P., M.B. Arvin, S. Bahmani, J.H. Hall and N.R. Norman (2019), "The Nexus between Economic Growth, Stock Market Depth, Trade Openness, and Foreign Direct Investment: The Case of ASEAN Countries," *Singapore Economic Review*, 63(1), 1-33.
- Pradhan, R.P., M.B. Arvin, J.H. Hall and N.R. Norman (2017), "ASEAN Economic Growth, Trade Openness and Banking-Sector Depth: The Nexus," *Economia*, 18(3), 359-379.
- Pradhan, R.P., M.B. Arvin, S.E. Bennett, M. Nair and J.H. Hall (2016a), "Bond Market Development, Economic Growth and Other Macroeconomic Determinants: Panel VAR Evidence," *Asia-Pacific Financial Markets*, 23, 175-201.
- Pradhan, R.P., D.B. Zaki, R.P. Maradana, D. Dash, M. Jayakumar and D. Chatterjee (2016b), "Bond Market Development and Economic Growth: The G-20 Experience," *Review of Applied Management Studies*, 13(1), 51-65.
- Riezman, R.G., P.M. Summers and C.H. Whiteman (1996), "The Engine of Growth or Its Handmaiden? A Time Series Assessment of Export-led Growth," *Empirical Economics*, 21(1), 77-113.

- Saint-Paul, G. (1992), "Fiscal Policy in an Endogenous Growth Model," *Quarterly Journal of Economics*, 107, 1243-1259.
- Saungweme, T. and N.M. Odhiambo (2019), "Government Debt, Government Debt Service and Economic Growth Nexus in Zambia: A Multivariate Analysis," *Cogent Economics and Finance*, 7, 1-17.
- Senibi, V., E. Oduntan, A. Ayo, I. Makwal and M. Eldad (2017), "Public Debt, Domestic Investment and Foreign Direct Investment in Nigeria: A Structural VAR Approach (1981-2015)," *International Journal of Innovative Research and Advanced Studies*, 4 (6), 508-519.
- Shahbaz, M. (2012), "Does Trade Openness Affect Long-Run Growth? Cointegration, Causality and Forecast Error Variance Decomposition Tests for Pakistan," *Economic Modelling*, 29, 2325-2339.
- Toktaş, Y., A. Altiner and E. Bozkurt (2019), "The Relationship Between Turkey's Foreign Debt and Economic Growth: An Asymmetric Causality Analysis," *Applied Economics*, 51(26), 2807-2817.
- Vaicekauskas, T. and A. Lakstutiene (2012), "The Effect of Public Debt and Other Determinants on the Economic Growth of Selected European Countries," *Economic and Management*, 17 (3), 914-921.
- Xu, Z. (1996), "On the Causality Between Export Growth and GDP Growth: An Empirical Reinvestigation," *Review of International Economics*, 4(2), 172-184.
- Yavari, K. and R. Mohseni (2012), "Trade Liberalization and Economic Growth: A Case study of Iran," *Journal of Economic Policy Reform*, 15(1), 13-23.
- Yong, S., R. Suhaimi and S. Chai (2017), "The Effect of Public Debt on FDI-Growth Nexus: Threshold Regression Analysis," *Advanced Science Letters*, 23(8), 7342-7345.

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