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Assessing the Economic Importance of Innovation in Nigeria: An Empirical Approach

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Abstract

The study examines the relationship between innovation and economic growth in Nigeria's context. In the study, patent applications, residents are used as the innovation indicator, while GDP growth (annual %) represents the economic growth measure. The analysis covers the period 2000-2020, with the use of Autoregressive Distributed Lag (ARDL) technique and Granger causality test based on VECM. Results indeed reflect the increased importance given to the knowledge-intensive side of the economy. The effect of innovation tends to be a major source of increased productivity and improved growth. This assertion aligns with the argument and reaffirms the idea that innovation is instrumental in enhancing economic performance. Furthermore, simultaneous improvements in innovation and economic growth are expected if positive changes happened to both indicators with similar magnitudes. The evidence shows that growth-innovation linkage is mutually inducing, reflecting a bi-directional feedback effect. Hence, directing public policies towards supporting innovation aimed at significantly influencing economic growth should be better advocated. Given that the enhancement of innovation efforts seems advantageous to the economy, it is necessary to redesign education and job training that could engender the presence of high-quality innovation, and to ensure the rational reallocation of resources around relevant innovative technologies.

Keywords: *Economic growth, innovation, public policy, ARDL, Nigeria.*

Introduction

In many developing countries, innovative-driven policies have led to improved economic performance over the past few decades. However, as differences in macroeconomic indicators across countries become more apparent, sustainable economic development trajectories will depend not just on the policies, but also on the innovative capacities of the people, especially Africans. The classification of sub-Saharan Africa as a developing region, in spite of its abundant human and material resources reflects the fact that there is a fundamental challenge facing the region in terms of harnessing and ensuring proper utilization of the human and material resources. Since innovation is defined as the basis for the economic development of knowledge and market-based economies, it plays a significant role in the global economy (Vuckovic, 2016). The creation and exchange process, and the effectiveness of commercialization through innovation remain a prerequisite for enhancing economic performance and employment opportunities. The innovation activities bolster the competitiveness of an economy, and thus result in meaningful societal progress. Significant attention has been accorded the role of innovation in the literature, as the level of economic development could be significantly shaped by it.

The neoclassical growth and endogenous growth theories advocate that technological advancement seems to be the key propeller of economic growth across economies (Solow, 1956; Romer, 1990). But how exactly new knowledge and advanced skills result in economic prosperity is not explicitly explained by the growth theories. Thus, the innovation-growth nexus remains equivocal. Empirical findings are bereft of sound theoretical underpinnings to proffer unequivocal answer to questions on how innovation can be one of the potential facilitators of economic growth in light of spillover effects (Wal and Boschma 2009; Tsvetkova, 2015). Since sustaining existing economic growth momentum is critical to addressing the challenges of enhancing meaningful development trajectories in an increasingly competitive global economy, lack of clear policy and capacity to innovate and adapt will undermine development aspirations. The capacity to resolve vital issues depends on new innovations and, especially African countries are in need of it more than ever. However, poor innovative drives in most SSA countries have far-reaching economic consequences for the region's economy, including Nigeria (OECD & EUROSTAT, 2005; Ajibike, Dapo, and Ologunde, 2020). For instance, the Global Competitiveness Index (GCI) indicates that innovation is the major contributor to innovation-driven economies (Global Innovation Index, 2018).

Continuous research on innovation-growth nexus may be another primary catalyst of increased productivity and instrumental in offering investment opportunities for any country. Focusing on how innovation impact on the economy could be better understood and enhanced should be a priority. In spite of this, the examination of the impact of research and development (R&D) and innovation on Nigerian economic growth is limited. While Akinwale et al. (2012) used the concept of Total Factor Productivity (TFP) to capture the effect of innovation on Nigeria's economy, Madsen (2010) employed both R&D and patents as measures of innovation in 21 OECD countries, and Ang and Madsen (2011) examined the role of R&D in the growth process of six Asian economies. In another study, Kacprzyk and Doryń (2017) used R&D expenditures to assess the nexus between innovation and economic growth in old and new member states of the European Union. Given that R&D investment enhances innovation (Ulku, 2004), patent applications, residents could be a good measure of innovation (Hasan and Tucci, 2010). Therefore, since only few studies seem to have incorporated this measure of innovation in their analysis, this study further contributes to the literature with the use of patent applications, residents to capture the impact of innovation on Nigerian economic growth.

The study aims at analyzing the question of whether any strong link exist between innovation and economic growth in Nigeria. The hypothesis to be tested is: innovation, measured by patent applications, residents, has a positive effect on GDP growth in Nigeria, and that public incentive arrangements reinforce this linkage. Indeed, a critical question for policy should be whether innovation generates a trade-off between increased business opportunities and economic growth. Understanding the dynamics of any trade-off is essential to better align policies towards stimulating potential gains to growth. Hence, the critical question of this study is: would public policy designed towards enhancing innovation have any influence on economic performance? In view of this, the study makes use of ARDL bounds testing to cointegration approach to examine the short-run and long-run impact of innovation on Nigerian economy. In the study, the dependent variable is GDP growth (annual %) while innovation (patent applications, residents) is the explanatory variable.

Literature review

The gap between the actual and planned development highlights the long-term importance of understanding the key instruments that drive the economy. While theoretically innovation has been identified as one of the key pillars that stimulates improved economy performance (Acs and Varga, 2002; Antonelli, 2017), studies on innovation-growth nexus remain inexhaustible. On the theoretical ground, evolutionary economics and the new economic growth theory have found explanations for innovation-growth linkage (Acs and Varga, 2002; Antonelli, 2017). Evolutionary economics maintains that innovations stimulate — the search for profit propels the outcome of entrepreneurial investments (Aghion et al., 2015). On the other hand, the new theory of economic growth recognizes the most significant productive factors (Sala-i-Martin, 2000) such as the knowledge spillover effects obtained from physical investment (Romer, 1986). They also include human capital (Lucas, 1988), R&D spending (Romer, 1990), public infrastructure development (Barro, 1990). These factors are viewed to be vital in growth enhancement process by the proponents of new economic growth theory. Basically, R&D investment is a fundamental factor of innovation, and in turn sustained economic growth. Thus, a deeper understanding of the innovative policies is critical to aiding the growth of economies (Ahlstrom, 2015).

Hasan and Tucci (2010) demonstrate that higher growth is experienced by countries with higher quality patenting firms, and likewise those that have patenting being increased. Similarly, in Hungary, Poland, and the Czech Republic, the impact of innovation on the economy is found to be positive, but seems to be moderate (Pece et al., 2015). Similar results are also obtained in a sample of 38 countries over the period 1981-2008 (Agénor and Neanidis, 2015). In contrast, with a set of 35 developing economies, Feki and Mnif (2016) find an adverse effect in the short run, while it offsets and turns positive over the long term.

The nexus is equally direct in Torres-Preciado et al. (2014), and it is stimulated by the presence of good innovation externalities. Mungaray et al. (2015) point out that there is positive effect of innovative capacity on income and productivity of exports of high-tech goods. Between 1988 and 1998, Beltrán-Morales et al. (2018) maintain that the national patent series (per employee) - output per capita linkage is positive. In addition, as argued by Wu et al. (2017) and Zhou and Luo (2018), in certain Chinese provinces, Technological advancement is the key driver of productivity growth. Christensen et al. (2019) find that investment in innovation can result in the creation of new markets that are beyond the primary motive of ensuring sustained economic growth, but an opportunity for underdeveloped nations to undergo economic prosperity. However, Kacprzyk and Doryń (2017) reveal that the impact is insignificant between old and new members of the European Union, whereas, when only the group of new countries is considered, the relationship is significantly positive, suggesting that, the stronger the nexus, when the level with which an economy matches with a steady-state-economy becomes less.

In terms of Causality which is also the subject of analysis, literature suggest that there could be bidirectional or unidirectional association between innovation and the growth of the economy. While using cointegration techniques and autoregressive models, Maradana et al. (2017 and 2019) find unidirectional causality in certain cases, and in some others, bidirectional is found. Bidirectional causality is also detected in many Latin American countries (Avila-Lopez et al., 2019). These findings indicate an investigation of a causal relationship between innovation and growth is indeed important in Nigeria's context.

Akinwale et al. (2012) posit that gross expenditure on R&D has a significant impact on Nigerian economic growth. But the estimate of R&D is adversely related to growth, implying that the effectiveness of increased spending on R&D and innovation might depend on the state of the quality of institutions. To fortify innovation-growth hypothesis, sound policies and institutions are required (Akinwale et al., 2012; Acemoglu and Robinson, 2012; Peng et al., 2017). It is therefore critical to ascertain whether the current level of innovation in Nigeria could guarantee sustainable growth path in the short-run, as well as in the long term.

Methodology and data description

This study follows the work of Acs and Varga (2002); Antonelli (2017) to form the growth-innovation nexus function as;

$$Y_t = f(INN_{t,} X_{t,}) \quad (1)$$

Where Y_t represents economic growth (GDP growth (annual %)), INN is the innovation indicator (patent applications, residents). X indicates other variables that could affect economic growth (such as domestic credit to the private sector (% of GDP) and gross capital formation (% of GDP), and control of corruption), and t is the time period.

In order to accounts for the problem of reverse causality and non-stationarity of variables, Autoregressive Distributed Lag (ARDL) technique in the form of a dynamic framework is employed. This approach is mostly significant as it can simultaneously capture both long run and short run impact within the same framework no matter the integration order of the variables. In addition, the use of ARDL technique is necessitated by its numerous usefulness compared to other estimation procedures (like Engle and Granger, 1987; Johansen, 1991). For instance, whether the variables are I (0), I (1) or a mixed order of integration, ARDL is applicable. Besides, ARDL procedure is good for small sample size, which suggests that it can account for the issue of biasness resulting from small sample size (Pesaran & Shin, 1997). Other cointegration methods are not suitable under these conditions. Thus, the ARDL model is given as follows:

$$\Delta Y_t = \alpha_o + \sum_{i=1}^{p} \alpha_1 Y_{t-i} + \sum_{i=0}^{p} \alpha_2 \Delta INN_{t-i} + \sum_{i=0}^{p} \alpha_3 \Delta DPS_{t-i} + \sum_{i=0}^{p} \alpha_4 \Delta GCF_{t-i} + \sum_{i=0}^{p} \alpha_5 \Delta COR_{t-i} + \vartheta_1 Y_{t-1} + \vartheta_2 INN_{t-1} + \vartheta_3 DPS_{t-1} + \vartheta_4 GCF_{t-1} \, \vartheta_5 \, COR_{t-1} + \mu_t \quad (2)$$

Where μ is the error term, Δ denotes difference operator. DPS is the domestic credit to the private sector, GCF is defined as the gross capital formation, and COR is control of corruption.

To trace the cointegration association between the dependent variable (Y) and the explanatory variables, restriction is placed on all the estimates of lagged level variables which are set to be equal to zero. Meaning that null hypothesis; $H_o : \vartheta_i = 0$ (where i = 1, 2, ……., 5), against the alternative hypothesis: $H_1 : \vartheta_i \neq 0$. Under this condition, the null hypothesis could imply that there is no long run nexus among the variables, but the alternative hypothesis suggests that there is existence of long run association among the variables.

Decision rule: if the calculated F – statistics is below the lower bound critical value, the null hypothesis of no integration is not rejected. However, the null hypothesis is rejected, if calculated F – statistics is above the upper bound critical value. On the other hand, if the calculated value is found within the bound, the decision could be regarded as inconclusive. In the presence of long run relationship among the series, error correction representation is ascertained (Pesaran, Shin, & Smith, 2001). Therefore, Eq. (2) in terms of the error correction model is given as:

$$\Delta Y_t = \alpha_o + \sum_{i=1}^{p} \alpha_1 \Delta Y_{t-i} + \sum_{i=0}^{p} \alpha_2 \Delta INN_{t-i} + \sum_{i=0}^{p} \alpha_3 \Delta DPS_{t-i} + \sum_{i=0}^{p} \alpha_4 \Delta GCF_{t-i} + \sum_{i=0}^{p} \delta_5 \Delta COR_{t-i} + \pi ECT_{t-1} + \mu_t \quad (3)$$

In Eq. (3) ECT indicates the residuals obtained from the estimate of Eq. (2), while π represents the speed of adjustment parameter. The parameter of error correction term (ECT) in the model is expected to be negative and significant, and after a short-run shock, suggests that the speed of adjustment is back to long-run equilibrium.

On the causality, based on the work of Maradana et al. (2017 and 2019); (Avila-Lopez et al., 2019), the model is given as follows;

$$\Delta Y_t = \sum_{k=1}^{p} \propto_{1j} \Delta Y_t + \sum_{k=1}^{p} \propto_{2k} \Delta INN_{t-k} + \Delta u_{1t} \quad (4)$$

$$\Delta INN_{it} = \sum_{k=1}^{p} \alpha_{1j} \Delta INN_{it-k} + \sum_{k=1}^{p} \alpha_{2k} \Delta Y_{t-k} + \Delta u_{2t} \quad (5)$$

Where k=1 is the minimum lag length selection starting from 1, while p denotes the maximum lag selected for the model.

In the study, Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) are examined to know the stable nature of the model. This condition is regarded as the test of stability (CUSUM and CUSUMSQ). Brown et al. (1975) demonstrate that with this test, the specifications of break points are not necessary unlike Chow test. Furthermore, lags selection for the model is based on Schwarz Information Criteria (SIC). The analysis covers the period 2000 – 2020. The description of data and sources are presented in Table 1.

Table 1. Description of data and sources.

Variable	Code	Description and measurement	Source
GDP growth (annual %)	*GDP*	It is the annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2015 U.S. dollars	World development indicator (World Bank, 2021)
Patent applications, residents	*INN*	These are worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention--a product or process that provides a new way of doing something or offers a new technical solution to a problem. A patent provides protection for the invention to the owner of the patent for a limited period, generally 20 years.	World development indicator (World Bank, 2021); World Intellectual Property Organization (2020)
Gross capital formation (% of GDP)	*GCF*	It consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories.	World development indicator (World Bank, 2021)
Control of corruption	*COR*	It captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	World Governance Indicators (Kaufmann, et al., 2010)
Domestic credit to private sector (% of GDP)	*DPS*	It refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.	World development indicator (World Bank, 2021)

Empirical results and discussion

Summary statistics and correlation analysis

Table 2 & 3 give the descriptive statistics and correlation outcomes, respectively. The characteristics of each of the variables are known through these results. Following this, the mean values of GDP growth and the innovation indicator are 5.31 and 58.48 accordingly, while their correspondent standard deviation values reported to be 3.82 and 27.88. The respective maximum and minimum figures of GDP growth are 15.33 and -1.79, whereas for the innovation variable, they are 120.00 and 31.00. Regarding the control variables, the control of corruption has the lowest average value (-1.15), indicating that corruption control measures may be poor. On the correlation analysis, in Table 3, the reports reveal that GDP and innovation are directly and significantly related. Similarly, other variables in the model equally maintain direct association with GDP growth.

Table 2. Summary Statistics.

	GDP	INN	GCF	DPS	COR
Mean	5.31	58.48	22.23	11.73	-1.15
Median	6.06	48.00	21.25	11.16	-1.12
Maximum	15.33	120.00	34.11	19.63	-0.89
Minimum	-1.79	31.00	14.90	8.08	-1.43
Std. Dev.	3.82	27.88	6.26	3.22	0.13
Skewness	0.24	1.11	0.27	0.97	-0.43
Kurtosis	3.95	2.75	1.68	3.47	2.87
Jarque-Bera	0.98	4.33	1.79	3.46	0.67
Probability	0.01	0.03	0.01	0.08	0.02
Sum	111.45	1228.00	466.92	246.240	-24.14
Sum Sq. Dev.	291.72	15543.24	784.03	206.10	0.33
Observations	21	21	21	21	21

Table 3. Correlation matrix.

Variable	GDP	INN	GCF	DPS	COR
GDP	1.00				
INN	0.72***	1.00			
GCF	0.24	0.18	1.00		
DPS	0.18	0.12	-0.50**	1.00	
COR	0.56**	0.47**	-0.37	0.71***	1.00

Unit root, cointegration and stability test

Given the significance of the need to know the order of integration of the variables, Augmented Dickey Fuller (ADF) and Philips-Perron (PP) unit root tests were conducted. In Table 4, results show that there are presence of I(0) and I(1) among the series, but no I(2) and above in the model. In light of this order of integration, ARDL bounds test approach is considered good for the study based on Pesaran et al. (2001). In Table 5, F-bounds test for cointegration confirms the existence of cointegration among the series, as calculated F-statistics exceeds the upper bound value at 5% level of significance. Accordingly, the null hypothesis of no long-run cointegration is rejected. Furthermore, the test of stability shows that the specification is stable as shown in Figure 1. On the stability test, CUSUM & CUSUMSQ fall within the critical bounds at 5% significant level, which suggests that the model is well specified and reliable. In order to ascertain the robustness of the estimates, various diagnostic tests were carried out (report at the lower part of Table 6), and they all give credence to the validity of the results.

Table 4. Unit root test.

Variable	*Augmented Dickey Fuller (ADF)*			*Phillips Perron (PP)*		
	Level	*First difference*	*Status*	*Level*	*First difference*	*Status*
GDP	0.24 (0.96)	-3.99** (0.01)	I(1)	-1.76 (0.39)	-7.69** (0.00)	I(1)
INN	1.30 (0.10)	-4.14** (0.00)	I(1)	-0.66 (0.84)	-4.65** (0.00)	I(1)
DPS	-2.84 (0.07)	-3.46** (0.02)	I(1)	2.00 (0.28)	-3.08*** (0.04)	I(1)
GCF	-1.22 (0.64)	-5.32*** (0.00)	I(1)	-1.76 (0.39)	-4.99*** (0.00)	I(1)
COR	-3.73 (0.01)	—	I(0)	-1.82 (0.36)	-4.41*** (0.00)	I(1)
***represents 1%; and **indicates 5% significance level.Values in bracket are probability values, while the ones with no bracket are t-statistical values.						

Table 5. F-bounds test for cointegration.

Test statistic	*Value*	*K*
F-statistic (Model 1) (2, 0,2,1,1)	5.87.	4
Significance	*I(0) lower bound*	*I(1) upper bound*
1%	3.74	5.06
5%	2.86	4.01
10%	2.45	3.52

Note: in the ARDL model, K is the number of independent variables

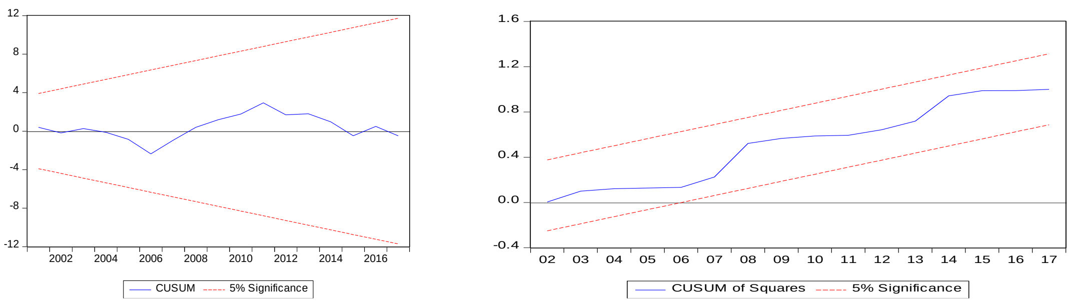

Figure 1: stability test

ARDL long run and short run estimates

In Table 6, both short run and long run estimates are presented. Results point out the significance of innovation for Nigerian economy. It is revealed that the level of economic growth could be significantly driven by innovation, as the innovation indicator used is found to have positively influenced the rate of growth in both short run and long run. This corroborates the assertion that the number of patent applications seems to be directly associated with the level of economic performance of a country (Che Sulaiman et al., 2021; Beltrán-Morales et al., 2018). In this regard, innovation is vital in leapfrogging the Nigerian economy from a resource-based to a knowledge-based one, since it can represent a primary driver for economic growth. These findings indeed support the view that having a good innovation-driven atmosphere would foster economic progress (Christensen et al., 2019; Ajibike, and Ologunde, 2019; Ajibike, Tejumade and Ologunde, 2020). However, the rate of economic growth could be undermined by the absence of a well-functioning innovation system. Thus, sustaining strong innovative capacity is a crucial element in enhancing growth process.

On the control variables, domestic credit to the private sector, gross capital formation and control of corruption are positively related to economic growth. These variables are also found to have a significant impact (except the control of corruption in the long run) in the short run as well as in the long run, indicating that they play an important role in the growth process. The insignificance of the corruption indicator could be attributed to the pervasive poor corruption control measures in the country (Fagbemi and Olatunde, 2019). In this direction, the study seems to be differed compared to previous ones who emphasize that the quality of institutions is a significant factor that fortifies innovation-growth hypothesis (Acemoglu and Robinson, 2012; Peng et al., 2017). Nonetheless, findings buttress the view that investment in capital is critical to stimulating growth (Wu et al., 2017; Zhou and Luo, 2018).

Table 6. ARDL long run and short run estimates.

Long run estimate		***Short run estimate***	
INN	0.21*** [5.41]	*ΔINN*	0.01** [2.98]
DPS	0.03** [3.16]	*ΔDPS*	0.25*** [3.41]
GCF	0.55*** [6.26]	*ΔGCF*	0.51** [2.88]
COR	0.04 [0.87]	*ΔCOR*	0.02** [2.83]
C	0.37*** [8.11]	*ECM*	-1.92** [-4.18]
Diagnostic test			
Durbin-Watson	2.01		
Breusch-Godfrey serial correlation test	0.41		
Ramsey reset test	0.78		
Normality test	0.29		
***, ** indicate 1% and 5% level of significance respectively			

Granger causality test based on VECM

Based on the argument that there could be a feedback effect between innovative capacity and economic growth, the direction of causality between these indicators is as well examined. In Table 7, it is reported that economic growth, in the long run, is reinforced by the presence of innovative drive. On the other hand, the growth of the economy is also found to enhance the level of innovation capacity. This suggests that growth-innovation link tends to be mutually inducing, reflecting a bi-directional feedback effect. The direction of causality implies that innovation activities may be positively facilitated by increased economic growth and vice versa which shows support for the work of Avila-Lopez et al. (2019) regarding Latin American countries. These results indicate that supporting formidable structures aimed at fostering innovation could cause the economy to improve. Such economic improvements may likewise stimulate national patent applications.

Table 7. Granger causality test based on VECM.

Lag	Dependent variable	Independent variable (source of causation)		
		Short run		Long run
		ΔGDP	*ΔINN*	*ECT*
2	*ΔGDP*	—	4.89*** (0.00)	-0.21 [-4.01]***
2	*ΔINN*	3.35 (0.03)	—	-0.11 [-2.99]**
P-values listed in bracket, while t-statistic listed in parentheses. *** and ** represent significance level at 1%, and 5%, respectively.				

In sum, results confirm the centrality of embracing the initiatives to innovate in an economy. In addition to being consistent with the hypothesis of market-enhancing effect, innovative drive in the economy is a crucial determinant of the level of economic activity. Thus, in the Nigerian case, it is important to emphasize that designing an appropriate innovation policy is critical to attaining improved economic performance. These same findings could be essential in relation to the long-term multiplier given the possible greater effect on economic growth in the long run. The Lag Order Selection Criteria is based on Schwarz information criterion (see Table A1).

Conclusion

To identify the possibilities that a developing country like Nigeria has to foster the innovation, the study examines the relationship between innovation and economic growth in Nigeria's context. In this regard, patent applications, residents are used as the innovation indicator, while GDP growth (annual %) represents the economic growth measure. The analysis covers the period 2000-2020, with the use of Autoregressive Distributed Lag (ARDL) technique and Granger causality test based on VECM. Results indeed reflect the increased importance given to the knowledge intensive side of the economic activity.

Following the findings, strengthening innovation-growth nexus is critical to creating positive change in the economy. The fundamental outcomes of innovation's impact on Nigerian economic growth is an indication that it is the core factor for modern development trajectories in this context. In this sense, the effect of innovation tends to be a major source of increased productivity and improved growth. This assertion aligns with the argument and reaffirms the idea that innovation is instrumental in enhancing economic performance. Furthermore, simultaneous improvements in innovation and economic growth are expected if positive changes happened to both indicators with similar magnitudes. The point of emphasis here is that growth-innovation linkage is mutually inducing, reflecting a bi-directional feedback effect. However, given these interconnections, it can be somewhat challenging to have low innovative capacity and poor innovation drive in the economy.

The path to the economy of innovation may be difficult, the usefulness of designing public policy measures that enhance a long-term vision for an innovative economy is crucial. Hence, directing public policies towards supporting innovation aimed at significantly influencing economic growth should be better advocated. Given that the enhancement of innovation efforts seems advantageous to the economy, it is necessary to redesign education and job training that could engender the presence of high-quality innovation, and to ensure the rational reallocation of resources around relevant innovative technologies.

Appendix

Table A1. Lag Order Selection Criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-216.6414	NA	9337.329	23.33067	23.57921	23.37274
1	-166.6323	68.43356	750.3093	20.69813	22.18935	20.95051
2	-102.4873	54.01684*	24.71789*	16.57761*	19.31151*	17.04029*

* indicates lag order selected by the criterion at 5% level. LR: sequential modified LR test statistic; FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

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