P ISSN 2086-3128 | E ISSN 2502-180x

Economic Journal of Emerging Markets

Accredited by Kemenristek/BRIN No.: 200/M/KPT/2020

Volume 14 Issue 2, 2022, Pages: 151-286

Economic Journal of Emerging Markets

https://journal.uii.ac.id/JEP

Editorial Office

Faculty of Economics, Universitas Islam Indonesia
Condong Catur, Depok, Sleman, Yogyakarta, Indonesia, 55283
Phone: +6274-881546, 883087, Fax +6274-882589
E-mail: editor.ejem@uii.ac.id

Economic Journal of Emerging Markets (EJEM) is a peer-reviewed journal which provides a forum for scientific works pertaining to emerging market economies. Published every April and October, this journal welcomes original quantitative research papers on economic issues and problems in emerging markets. The journal is fully open access for scholarly readers.
The journal was first published in 1993 as Jurnal Ekonomi (ISSN 0854-5723), which then changed to Jurnal Ekonomi Pembangunan (JEP) in 1996 (ISSN 1410-2641), and since 2009 has become Economic Journal of Emerging Markets (EJEM, ISSN 2502-180X). The journal is published by the Center for Economic Studies, Universitas Islam Indonesia, Yogyakarta, Indonesia.

Economic Journal of Emerging Markets

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Economic Journal of Emerging Markets

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EJEM
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Economic Journal of Emerging Markets
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Revisiting the threshold effect of corruption in the link between public debt and economic growth in Nigeria

Eyitayo Oyewunmi Ogbaro[1*], Ademola Obafemi Young[2], Rebecca Folake Bank-Ola[3]

[1,3]Department of Economics, Faculty of Business and Social Sciences, Adeleke University, Ede, Osun State, Nigeria.
[2]Department of Economics, College of Humanities, Management and Social Sciences, Mountain Top University, Ogun State, Nigeria.
[*]Corresponding author: ogbarooye@yahoo.com; eyitayo.ogbaro@adelekeuniversity.edu.ng

Article Info

Article history:
Received 6 February 2022
Accepted 5 September 2022
Published 5 October 2022

JEL Classification Code:
H630, O470, N470, C240

Authors' emails:
aoyoung@mtu.edu.ng
bankolafolake@gmail.com

DOI: 10.20885/ejem.vol14.iss2.art1

Abstract

Purpose — This study contributes to the empirical literature on the nonlinear relationship between public debt and economic growth in Nigeria using threshold regression methodology. It provides insight into how Nigeria can grow out of debt sustainably in the face of the prevailing level of corruption as an institutional indicator.

Method — Stata's threshold command is used for data analysis, and this command fits time-series threshold models in finding the optimal number of thresholds. It does this by minimising an information criterion and using conditional least squares to estimate the parameters of the threshold regression model.

Findings — The results show that the relationship between public debt and economic growth is nonlinear. The threshold effect of public debt on growth depends on the debt-to-GDP ratio and the level of corruption. Substantial evidence supports two threshold levels of debt-to-GDP ratio and corruption in the debt-growth nexus. The two threshold levels of corruption are 63.21 and 64.27 (on a scale of 0 to 100), with the growth effect of public debt being positive and significant in the second regime only.

Implication — Public debt exerts significant positive effects on growth as long as corruption is kept at a moderate level. Thus, the government of Nigeria needs to ensure that corruption is pegged at a fairly moderate level that will guarantee the positive contribution of accumulated debt to economic growth.

Originality — Unlike previous works, the study addresses the problem caused by the mechanical effect of a change in the real GDP growth rate on debt. It is based on the assumption of a maximum of two thresholds.

Keywords — Public debt, corruption, economic growth, Nigeria, non-linearity, threshold.

Introduction

Concerns have been expressed that the rate at which African countries accumulate debt poses a serious problem to the sustainability of such debts. This suggests the possibility of these countries slipping into debt crisis unless proactive steps are taken. According to Mustapha and Prizzon (2018), a country is said to be in debt distress when it is struggling to service its debt, as

P ISSN 2086-3128 | E ISSN 2502-180X

demonstrated by arrears, among others. World Bank (2018) claims that as of 2018, almost 40% of countries in sub-Saharan Africa (SSA) were in danger of slipping into a major debt crisis. The susceptibility of African economies to debt crisis has increased lately due to the COVID-19 pandemic. For example, the African Development Bank (AfDB, 2021) analysed the debt sustainability of thirty-eight African countries in December 2020 and found six already in debt distress, while fourteen were at high risk of debt distress. The findings also revealed that sixteen countries had a moderate risk of debt distress, while two faced low risk. Besides, the International Monetary Fund (IMF, 2020) report shows that Africa's average debt-to-Gross Domestic Product (GDP) ratio is still higher than the recommended debt sustainability threshold of 60%. This is because the figure is expected to decline from 69.3% in 2020 to 65.1% in 2023.

The AfDB (2021) has argued that for countries to grow out of debt sustainably, they would need to improve the efficiency of debt-financed investments through institutionalised transparency and accountability. This suggests that solid institutional indicators, such as the absence of corruption, are crucial if public debt is to be used to finance projects that will generate sufficient benefits. The benefits will promote growth and ensure the sustainability of the debt accumulated. By implication, debt sustainability requires setting a benchmark level for the debt-to-GDP ratio and ensuring sufficient institutional quality. The argument that the growth effect of public debt depends on the prevailing institutional indicators is supported in a study by Kourtellos, Stengos, and Tan (2013). The findings of the study show, in part, that public debt leads to lower growth in countries where institutionalised democracy falls below a particular level.

This present study aims to contribute to this body of knowledge by investigating the role of the level of corruption as an institutional indicator in the debt-growth nexus in Nigeria. The choice of Nigeria is informed by the argument of Devarajan, Gill, and Karakulah (2019) that whether or not most countries in Africa will succeed in escaping debt distress depends to a large extent on what happens to any of the continent's large economies. The implication of this is that the ability of countries such as Nigeria and South Africa to avoid falling into debt crisis has severe consequences for other countries in the region. Like many countries, Nigeria has become highly vulnerable to the global economic disruption caused by COVID-19. For instance, the proportion of government revenue used in servicing the country's debt, which the World Bank (2020) puts at just more than 60% in 2019, increased to 76.2% between January and November 2021.

Apart from the level of corruption, the paper also investigates the role of the debt-to-GDP ratio in the nexus. This is due to the findings of some studies, including Chang and Chiang (2009) and Minea and Parent (2012), that the debt-to-GDP ratio is a crucial factor that determines the growth effect of public debt. Therefore, this present study follows these works in paying attention to non-linearity in the debt-growth link. Apart from empirical considerations, the decision to pay attention to non-linearity is also based on theoretical considerations. For example, Atil, Lahiani, and Nguyen (2014) argue that most time series behave nonlinearly over time and often follow a nonlinear pattern in their interaction with each other.

The plethora of studies on the debt-growth nexus can be categorised into two based on their relationship modelling. The first category of studies assumes that the relationship between debt or its components and growth is linear. These studies can be grouped into three strands within the Nigerian context based on the estimation method employed. The first strand adopts the approach of ordinary least squares (OLS) and obtains conflicting results. Studies in this strand include Akinwunmi and Adekoya, (2018), Alagba and Idowu (2019), Laosebikan, Alao, Ajani, Alabi, and David (2018), Ogege and Ekpudu (2011) as well as Umaru, Hamidu, and Musa (2013). These studies arrive at results that are not generally conclusive.

The second strand, which employs the error correction model (ECM), also generates mixed results. This strand is made of studies such as Abula and Ben (2016), Aigheyisi and Ogbebor (2019), Ebi, Abu, and Clement (2013), Elom-Obed, Odo, Elom-Obed, and Anoke (2017), Ijirshar, Joseph, and Godoo (2016) as well as Udeh, Ugwu, and Onwuka (2016).

The last strand is made of studies that employ the autoregressive distributed lag (ARDL) model for their estimation. These studies include Anderu, Omolade, and Oguntuase (2019) as well as Eze, Nweke, and Atuma (2019). The results of both studies show a negative and significant

effect of external debt on growth. In addition, Eze et al. (2019) find that the impact of domestic debt is positive and insignificant.

A serious defect of the three strands that make up the first category of studies is their assumption of linearity in the debt-growth link. Such an assumption has been criticised as too restrictive since such a specification ignores the possibility of a non-linearity in the nexus. Ogbaro, Young, and Bank-Ola (2021) have argued that the possibility of the existence of non-linearity in the relationship is a more plausible assumption. Many studies have been conducted to address the shortcoming of the first category of studies by focusing on the nonlinear relationship between debt and growth. Nevertheless, the scope of this paper is limited to those that capture non-linearity using threshold regression methodology. The use of the threshold methodology has generally yielded conflicting results, particularly concerning the tipping point of the threshold variable. For example, Chang and Chiang (2009) find two thresholds of 32.3% and 66.25% for the debt-to-GDP ratio, with debt having significant positive growth effects in the three regimes. On the other hand, Caner, Grennes, and Köhler-Geib (2010) find a threshold level of 77%, beyond which public debt hampers growth. On their part, Minea and Parent (2012) find that public debt exerts a negative effect on growth when the debt-to-GDP ratio lies between 90 and 115%.

In addition, Cecchetti, Mohanty, and Zampolli (2011) find a threshold level of 95% for the debt-to-GDP ratio. Baum, Checherita-Westphal, and Rother (2013) find that while public debt has a significantly positive effect on growth in the short run, the impact becomes insignificant at debt-to-GDP ratios above 67%. The results of the study by Kourtellos et al. (2013) show that the threshold level of institutionalised democracy is about 4.6 (on a scale of 1 to 10), below which public debt leads to lower growth. Using Malaysian data from 1970 to 2011, Daud and Podivinsky (2014) find that the threshold levels of indices of economic freedom as a measure of institutional quality range between 5.8 and 7.2 (on a scale of one to ten). Égert (2015) finds evidence in support of an adverse effect of debt on growth when the debt-to-GDP ratio lies between 20 and 60%. Chudik, Mohaddes, Pesaran, and Raissi (2017) find a debt threshold of between 60 and 80%. Yolcu-Karadam (2018) finds a threshold level of 106.6% for debt using data on 136 developed and developing countries, including Nigeria. Croi and Diaw (2020) find a debt threshold of 54.5%, beyond which the net growth effect of debt is positive and significant when institutional quality is considered. Finally, Hassan and Meyer (2021) find a threshold level of 5.1 for institutional quality (on a scale of 0 to 10) above which external debt contributes to the growth process.

A notable feature of those that captured Nigeria among these studies is that their analysis is based on panel data. This has been faulted by Augustine and Rafi (2021) and Ogbaro et al. (2021). The authors argue that panel data rule out the possibility of accounting for country-specific differences. In light of this, Augustine and Rafi (2021) disagree with the option of simultaneously fitting a single threshold for a sample of countries. Hence, they emphasise the need for finding country-specific thresholds in the debt-growth link. Another limitation of the studies is their failure to capture the role of corruption as an institutional factor.

The only study that has attempted to address these defects in Nigeria is the one by Ogbaro et al. (2021). Based on quarterly data from 1984 to 2017, the study finds a threshold level of about 90% for the debt-to-GDP ratio. The authors also find that the threshold level of corruption is about 64 (on a scale of 0-100). One of the shortcomings of that study is its assumption of the existence of a single threshold level. This assumption is too restrictive since the number of thresholds may be more than one, as shown by studies such as Chang and Chiang (2009) as well as Minea and Parent (2012).

Furthermore, the analysis carried out by the study fails to address a serious problem that scholars such as Augustine and Rafi (2021) as well as Égert (2015) have associated with the correlation between debt and economic growth. According to scholars, the problem stems from the mechanical effect of a change in the real GDP growth rate on debt. To address this problem, they suggest using the lagged value of change in debt instead of contemporaneous debt.

Consequently, this present study contributes to the existing literature by complementing the study of Ogbaro et al. (2021). It examines the existence of threshold effects in the debt-growth nexus in Nigeria based on the assumption of a maximum of two thresholds.

Methods

The theories underpinning the empirical analysis carried out in this study are the New Institutional Economics (NIE) and the Debt Laffer Curve theory. Scholars have attributed the NIE to the seminar works of Matthews (1986), North (1990), North and Thomas (1973), and Williamson (1985). It was proposed mainly to correct a significant defect of the neoclassical and endogenous growth theories, which take the existence of institutions as given. Unlike the earlier approaches, the proponents of NIE argue that establishing good or strong institutions is necessary if government policies yield the desired results in promoting growth. Given this, the role of NIE is not to replace the earlier theories but to address their major shortcoming. It does this by incorporating institutions into the earlier growth models.

In light of the above, therefore, this study begins its modelling with the specification of a production function which is augmented with a debt variable in the spirit of Ogbaro et al. (2021). The production function is specified as follows:

$$Y_t = Af(K_t, L_t, H_t, D_t) \tag{1}$$

where *Y* denotes economic growth, *A* stands for technology, *K* denotes physical capital, *L* denotes labour, *H* denotes human capital, while *D* denotes public debt. The study adopts a Cobb-Douglas specification of equation (1) as follows:

$$Y_t = AK_t^{\propto_1} L_t^{\propto_2} H_t^{\propto_3} D_t^{\propto_4} \tag{2}$$

Log-linearising the two sides of the production function in equation (2) and adding a stochastic disturbance or error term to the outcome yields the following:

$$lnY_t = \propto_0 + \propto_1 lnK_t + \propto_2 lnL_t + \propto_3 lnH_t + \propto_4 lnD_t + u_t \tag{3}$$

where ln denotes natural logarithm, $\propto_0 = lnA$, and u is the error term.

Equation (3) is extended by incorporating a measure of institutions into it in line with the tenet of the NIE as follows:

$$lnY_t = \propto_0 + \propto_1 lnK_t + \propto_2 lnL_t + \propto_3 lnH_t + \propto_4 lnD_t + \alpha_5 lnC_t + u_t \tag{4}$$

where C denotes institutional factor.

Equation (4) is transformed into a nonlinear one in light of the Debt Laffer Curve theory, which posits that the relationship between debt and economic growth is nonlinear. Specifically, the theory states that there exists an optimal level of debt below and above which public debt promotes and retards growth, respectively. Of the approaches that have been adopted in the literature in modelling non-linearity, the study employs the time series threshold regression methodology in the spirit of Ogbaro et al. (2021). In utilising this methodology, this study assumes the existence of a maximum of two thresholds based on the number of observations. This is an improvement on the study by Ogbaro et al. (2021), which assumes at most one threshold. Hence, the model is specified as follows:

$$\begin{aligned} lnY_t = {} & (\beta_{10} + \beta_{11} lnK_t + \beta_{12} lnL_t + \beta_{13} lnH_t + \beta_{14} lnD_t + \beta_{15} lnC_t) I\{q_t \leq \lambda_1\} + \\ & (\beta_{20} + \beta_{21} lnK_t + \beta_{22} lnL_t + \beta_{23} lnH_t + \beta_{24} lnD_t + \beta_{25} lnC_t) I\{\lambda_1 < q_t \leq \lambda_2\} + \\ & (\beta_{30} + \beta_{31} lnK_t + \beta_{32} lnL_t + \beta_{33} lnH_t + \beta_{34} lnD_t + \beta_{35} lnC_t) I\{q_t > \lambda_2\} \end{aligned} \tag{5}$$

where the definitions of variables remain the same as given above, while q and ε_t are the threshold variable and zero mean idiosyncratic random disturbance, respectively. $I\{.\}$ refers to an indicator function, λ_1 and λ_2 denote the two threshold parameters or values which divide the observations into three regimes, while $\beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}$; $\beta_{21}, \beta_{22}, \beta_{23}, \beta_{24}, \beta_{25}$; and $\beta_{31}, \beta_{32}, \beta_{33}, \beta_{34}, \beta_{35}$ denote the slope parameters corresponding to the three regimes, respectively.

The two threshold values split the observations or sample into three regimes or sub-samples. The first regime, also known as regime 1, refers to when the threshold variable is lower than the first threshold value (i.e., $q < \lambda_1$). The second regime, also known as regime 2, refers to when the threshold variable is higher than the first threshold value but lower than the second

threshold value (i.e., $\lambda_1 < q < \lambda_2$). The third and final regime, also known as regime 3, refers to when the threshold variable is higher than the second threshold value (i.e., $q > \lambda_2$). Since both public debt and corruption have the potential to cause the effect of debt on economic growth to vary across regimes, both are used as the threshold variable.

The threshold analysis carried out in this study is based on Stata 15's *threshold* command. The command fits time-series threshold models in finding the optimal number of threshold(s). It does this by minimising an information criterion and using conditional least squares to estimate the parameters of the threshold regression model. It uses the Wald test proposed by Judge, Griffiths, Hill, Lutkepohl, and Lee (1985) to confirm whether or not threshold effects exist in the relationship under study. Based on the testing option, the null hypothesis of linearity (i.e., absence of threshold effects) is first tested against the alternative of one threshold. If the results suggest the acceptance of the null, the threshold regression model in equation (5) is reduced to the linear model in (4). However, rejecting the null hypothesis would confirm the existence of a nonlinear relationship between debt and economic growth. In the event of the latter, the study uses the threshold option to determine the optimal number of thresholds from a maximum of two.

The study fits two threshold regression models in all, one with public debt as the threshold variable while the other is based on the use of corruption. The Sum of Squared Residuals (SSR) and three information criteria obtained from each of the two fitted models are compared to select the model with the better fit. The three information criteria are the Akaike, Bayesian and Hannan–Quinn information criteria. The model that contributes more to the minimisation of the SSR and the information criteria is chosen as the one with the better fit.

Based on the availability of data, time-series data on Nigeria are collected from secondary sources for the sample period 1981-2017. The natural logarithm of GDP (constant 2010 US$) is used as a measure of economic growth. Gross fixed capital formation as a percentage of GDP is used to measure physical capital. Life expectancy at birth (total) in years is used to measure human capital. Data on the three variables are sourced from the 2019 version of the World Bank's World Development Indicators (WDI). The number of persons engaged is used for measuring labour input, and data are sourced from Penn World Table (PWT), version 10.0. The public debt stock is measured using the gross government debt-to-GDP ratio obtained from the *International Monetary Fund (IMF) Historical Public Debt database*. However, the study uses lagged value of change in debt in its analysis in the spirit of Augustine and Rafi (2021) as well as Égert (2015). Finally, the Bayesian Corruption Indicator (BCI) is used as a proxy for the level of corruption. The BCI index, which lies between 0 (no corruption) and 100 (extreme corruption), is a composite index of the perceived overall level of corruption. All the collected data are converted into quarterly series using the linear interpolation method to have sufficient data points for the threshold estimation.

Results and Discussion

This section presents a formal analysis of the threshold effects of the debt-to-GDP ratio and corruption level on Nigeria's debt-growth nexus. The study begins with examining the descriptive statistics of the data used for the analysis. Results obtained from this task are displayed in Table 1. The table shows that the minimum and maximum public debt-to-GDP ratios are 11.6039% and 193.6710%, respectively. Compared to the recommended threshold of 60%, the former may be considered sustainable, while the latter would appear beyond the sustainable level. The minimum value was recorded in the first quarter of 2006, which can be attributed to Nigeria's agreement with the Paris and London Clubs of Creditors at the end of 2005. The country was allowed to buy back about $30 billion of her $32 billion external debts via a one-time cash payment of $12 billion. On the other hand, the maximum value was recorded in the first quarter of 1993. This can be attributed to the policy of giving back to petroleum companies, part of Nigeria's gains practised during that period.

The table also reveals that minimum and maximum corruption indices are about 61 and 68, respectively, on a scale of 0 to 100. Since both values are above the half mark, this may be interpreted to mean the prevalence of the problem of corruption in the country. In addition, the

minimum and maximum levels of corruption were recorded in the first quarter of 1984 and the first quarter of 2014, respectively. It implies that, apart from being prevalent, the problem has worsened in Nigeria over the years.

Table 1. Descriptive Statistics of Data

Variable	Mean	Minimum	Maximum
GDP	2.33e+11	1.08e+11	4.67e+11
Physical Capital	35.972	14.168	89.386
Labour	4.07e+07	2.64e+07	7.06e+07
Human Capital	48.028	45.637	54.236
Public Debt	69.441	11.603	193.671
Corruption Index	63.597	61.281	67.724

The econometric analysis in this study begins with the sequential tests for the optimal number of thresholds of public debt and level of corruption appropriate for estimating equation (5). The null hypothesis of no threshold effects (i.e., the existence of linearity) is first tested against the hypothesis of, at most, a single threshold (i.e., the presence of two regimes). The results of this test, which are presented in Table 2, show that the null hypothesis of no threshold is rejected at the 5 per cent significance level for the two threshold variables with Wald statistics of 136.14 and 345.96, respectively (p-value < 0.05). This implies rejecting a linear relationship between Nigeria's public debt and economic growth. Given this, the hypothesis of a single threshold is also tested against two thresholds as presented in Table 2. The results reveal Wald statistics of 282.95 and 448.80 for the two threshold variables, respectively (p-value < 0.05). This indicates the rejection of the assumption of a single threshold in favour of two thresholds.

Table 2. Threshold Effect Test Using Public Debt as the Threshold Variable

Threshold Variable	Single Threshold Model	Double Threshold Model
Public Debt:		
Wald Statistic	136.14	282.95
$p-value$	0.00	0.00
Corruption:		
Wald Statistic	345.96	448.80
$p-value$	0.00	0.00

Table 3. Threshold Regression Results Using Public Debt as the Threshold Variable

Regressor	Regime 1	Regime 2	Regime 3
Constant	6.024	-59.053	217.043
	(1.297)	(16.326)	(29.634)
Log of Physical Capital	-0.282***	0.008	0.157***
Log of Labour	(0.025)	(0.079)	(0.058)
	0.387***	-0.159	4.335***
Log of Human Capital	(0.099)	(0.330)	(0.679)
	2.287***	4.451***	-19.8028***
Log of Public Debt	(0.380)	(0.753)	(2.450)
	-0.042***	-0.240***	-0.032*
Log of Corruption	(0.012)	(0.046)	(0.019)
	1.350***	17.267***	-46.161***
	(0.291)	(5.114)	(9.596)
Debt Regime	$q < 43.02$	$43.02 < q < 83.56$	$q > 83.56$
Number of observations		148	

Notes: q denotes debt-GDP-ratio. The figures shown in parenthesis are robust standard errors. ***, ** and * represent significance at 1%, 5% and 10% levels, respectively.

Hence, the study estimates equation (5) using two threshold levels of both public debt and corruption, with the results obtained from the former presented in Table 3. The results show that the two threshold values of the debt-to-GDP ratio are about 43% and 84%. The second threshold value is less than the single threshold of about 90% obtained by Ogbaro et al. (2021) but is equal to the one obtained by Caner et al. (2010). The results also show that below the first threshold value of the debt-to-GDP ratio (regime 1), both public debt and physical capital significantly negatively affect economic growth. However, the effects of labour, human capital and corruption are positive and significant in that regime. At any debt-to-GDP ratio higher than the first threshold value but lower than the second threshold value (regime 2), both public debt and labour have adverse effects on economic growth, with the latter's impact being insignificant. However, the coefficients on human capital, corruption and physical capital are positive, although that of the latter is insignificant. The findings also reveal that while the coefficients on physical capital and labour are positive and significant at 1% in the third regime, those on human capital, corruption and public debt are negative.

Table 4 shows the results obtained from using corruption as the threshold variable in equation (5) estimation. The results show that the two threshold values of corruption are about 63 and 64. The second threshold value is equal to the single threshold value obtained by Ogbaro et al. (2021). The findings also reveal that below the first threshold value of corruption (regime 1), labour, human capital and public debt exert adverse effects on economic growth, although the latter's impact is insignificant. However, the effects of physical capital and corruption are positive and significant in that regime. At any level of corruption above the first threshold value but below the second threshold value (regime 2), physical capital, human capital, public debt and corruption all significantly positively affect economic growth. However, the coefficient on labour input is negative and insignificant. The results further indicate that at the level of corruption above the second threshold value (regime 3), physical capital, public debt and labour exert negative effects on economic growth, although the effect of the latter is insignificant. The effects of human capital and corruption are positive, although that of the latter is insignificant.

Table 4. Threshold Regression Results Using Corruption as the Threshold Variable

Regressor	Regime 1	Regime 2	Regime 3
Constant	41.307	-133.386	0.735
	(10.779)	(11.792)	(3.142)
Log of Physical Capital	0.150***	0.164***	-0.115**
Log of Labour	(0.044)	(0.059)	(0.044)
	-0.654***	-0.448	-0.336
Log of Human Capital	(0.099)	(0.359)	(0.272)
	-22.886***	5.991***	8.178***
Log of Public Debt	(1.820)	(1.267)	(1.287)
	-0.012	0.049***	-0.333**
Log of Corruption	(0.010)	(0.016)	(0.135)
	20.007***	34.530***	0.232
	(3.160)	(2.958)	(0.490)
Corruption Regime	$q < 63.21$	$63.21 < q < 64.27$	$q > 64.27$
Number of observations		148	

Notes: q denotes the level of corruption. The figures shown in parenthesis are robust standard errors. ***, ** and * represent significance at 1%, 5% and 10% levels, respectively.

Table 5 shows the SSR and the three information criteria obtained from the two fitted regression models. It can be seen from the table that the model that is based on the use of corruption as the threshold variable provides a better fit. This is because it has lower SSR and information criteria than the model based on the use of debt itself.

These findings highlight four critical points about the issue of interest in Nigeria. One, the relationship between public debt and economic growth is nonlinear, implying the presence of threshold effects. Two, the effectiveness or otherwise of public debt in promoting growth in

Nigeria depends on the debt-to-GDP ratio and institutional factors. This accords with the results obtained by Chudik et al. (2017), Croi and Diaw (2020), Daud and Podivinsky (2014), De Pascale and Scrocco (2022), Gómez-Puig and Sosvilla-Rivero (2022), Hassan and Meyer (2021), Kim, Ha, and Kim (2017), Kourtellos et al. (2013), Sani, Said, Ismail, and Mazlan (2019), Yolcu-Karadam (2018), as well as Tarek and Ahmed (2017). The study also finds that the model involving corruption as the threshold variable provides a better fit than using the debt-to-GDP ratio. This implies that the results obtained from corruption as the threshold variable are more reliable than those obtained using the debt-to-GDP ratio. This supports Daud and Podivinsky (2014) assertion that ensuring sufficient institutional quality plays a more important role in ensuring public debt sustainability than just focusing on the debt alone.

Table 5. Test of Fit

Statistic	First Model	Second Model
Sum of Squared Residuals	0.0975	0.0901
Akaike information criterion	-940.0342	-950.5094
Bayesian information criterion	-911.1307	-921.6059
Hannan–Quinn information criterion	-928.2889	-938.7641

Note: First and second models represent the models based on using public debt and corruption index as the threshold variable, respectively.

Results further show that while public debt does not exert any significant positive influence on growth at deficient and very high levels of corruption, it exerts a significant positive influence on growth at moderate levels of corruption. This implies that corruption is not totally bad and that there exists some moderate level of corruption that contributes positively to the ultimate objective of economic growth. It is difficult to situate this finding within existing empirical studies. This is because those that captured the threshold effect of institutional quality assumed only the possible existence of one threshold level. However, the result is consistent with the argument by Nur-tegin and Jakee (2020) that corruption may have both the "grease" effect and the "sand" effect. The "grease" effect is derived from the "grease the wheels" hypothesis, which states that some level of corruption promotes growth because of its ability to overcome inefficient regulations. On the other hand, the "sand" effect is derived from the "sand the wheels" hypothesis, which states that corruption acts as a drag on economic growth by imposing a heavy tax on innovative activities. This study has found the "grease" effect to apply at moderate levels of corruption, while the "sand" effect is found to use at low and high levels of corruption for the same dataset.

The study contributes to the economic literature by estimating two threshold levels of corruption and the implications for the growth-debt link. Hence, policymakers are better informed on how to pursue sound debt management policies within the context of prevailing corruption, which is an aspect of institutional quality.

Conclusion

This study provides insight into how Nigeria can grow out of debt sustainably in the face of the overall level of corruption as an institutional factor. Based on findings, the study concludes that the Nigerian economy may face the problem of unsustainable debts, which can potentially hamper long-term growth and stability if the level of corruption in the country is not kept at a moderate level. Therefore, the study recommends that policymakers in Nigeria may not necessarily reduce the country's debt accumulation to mitigate the adverse effect of debt on growth. What is required is for them to be able to improve the country's institutional quality by ensuring that corruption is reduced to a relatively moderate level. This will facilitate the effective management of public debt and guarantee debt's positive contribution to the economy's growth.

Acknowledgment: Not applicable

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Economic Journal of Emerging Markets, 14(2) 2022, 162-175

EJEM
Econ.J.Emerg.Mark.

Economic Journal of Emerging Markets
Available at https://journal.uii.ac.id/jep

Revisiting the asymmetry between the exchange rate and domestic production in South Asian economies: Evidence from nonlinear ARDL approach

Javed Iqbal[1], Misbah Nosheen[2], Mark Wohar[3*]

[1]School of Economics, Quaid-i-Azam University Islamabad, Pakistan and Fulbright Postdoc Fellow, University of Nebraska, Omaha, NE USA
[2]Department of Economics, Hazara University Mansehra, Khyber Pakhtunkhwa, Pakistan and Postdoc Fellow, University of Nebraska, Omaha, NE USA
[3]College of Business and Administration, University of Nebraska, Omaha, NE USA
[*]Corresponding author: mwohar@unomaha.edu

Article Info

Article history:
Received 16 July 2022
Accepted 5 September 2022
Published 5 October 2022

JEL Classification Code:
F31, F43

Authors' emails:
javed@qau.edu.pk
javediqbal@unomaha.edu
misbah@hu.edu.pk and
mnosheen@unomaha.edu

DOI: 10.20885/ejem.vol14.iss2.art2

Abstract

Purpose — The present study investigates the asymmetric effect of exchange rate changes on the domestic production of selected South Asian economies from 1980-2019.

Design/Method/Approach—The study introduces nonlinearity into the adjustment process by decomposing the exchange rate into depreciation and appreciation and relying on the Nonlinear ARDL approach to cointegration.

Findings — The findings show significant evidence of asymmetric effects of exchange rate changes on domestic production in the case of South Asian economies. Surprisingly, depreciation promotes economic growth while appreciation impedes it in almost all economies.

Practical Implications — The findings refute the notion of symmetry, indicating that depreciation and appreciation have different effects on South Asian economies. An undervalued exchange rate may provide short-term economic relief. The study recommends that a market-based equilibrium exchange rate is crucial for these economies.

Originality/Value — By using a Nonlinear ARDL approach to separate exchange rate appreciation and depreciation, this study adds to the body of knowledge about the relationship between exchange rate and growth, particularly in South Asia.

Keywords — Asymmetric effects; exchange rate volatility; domestic production; South Asia; nonlinear ARDL

Introduction

Fluctuations in the exchange rate tend to affect most macroeconomic variables. These variations in the exchange rate may affect income, trade, investment, foreign direct investment, and consumption. This link has been widely investigated by researchers (Ayubu, 2013; Bahmani-Oskooee, Iqbal, & Nosheen, 2016; Bahmani-Oskooee, Iqbal, & Salam, 2016; Bahmani-Oskooee & Kandil, 2007; J. Iqbal, Nosheen, Tariq, & Manan, 2015; Kandil & Mirzaie, 2008). The link between real exchange rate (REX) changes and domestic production/economic growth (EG) is no exception (Bahmani-Oskooee, Halicioglu, & Mohammadian, 2018; Bahmani-Oskooee & Miteza, 2006; Bahmani-Oskooee & Mohammadian, 2016). Theory predicts that the depreciation of domestic currency may stimulate net exports by making exports internationally more competitive and may, therefore, raise

P ISSN 2086-3128 | E ISSN 2502-180X

aggregate demand (Bahmani-Oskooee, Iqbal, & Khan, 2017; Bahmani-Oskooee, Iqbal, & Muzammil, 2017; Bahmani-Oskooee, Nosheen, & Iqbal, 2017; Dornbusch, Krugman, & Cooper, 1976). In contrast, depreciation may raise the cost of imported inputs and the cost of production as well. Thus depreciation or devaluation is supposed to contract the domestic production and aggregate supply (Bahmani-Oskooee & Hajilee, 2010). The final effect of depreciation and appreciation depends upon the interaction between aggregate demand and supply channels. Depreciation may result in contraction if the expansionary aggregate demand is less than aggregate supply. On the other hand, if aggregate supply declines less than the expansionary aggregate demand, then the depreciation will be expansionary (Bahmani-Oskooee et al., 2018). At this point, the individual experiences of countries will provide further evidence of expansionary or contractionary depreciation. The countries that experience contractionary depreciation tend to be dependent on imported inputs. The more export-oriented countries will gain benefit from the depreciation.

In recent years, the nexus between the exchange rate and EG is an extensively debated issue in the literature and is the central macroeconomic goal of economic policy agenda across the globe (Easterly & Levine, 1997; Fischer, 1992; Knight, Loayza, & Villanueva, 1993; Most & De Berg, 1996). Many other studies investigating the impact of exchange rate uncertainty on EG reported mixed findings (Ahmad, Hayat, Luqman, & Ullah, 2012; Akhtar & Malik, 2000; Ali & Anwar, 2016; Baron, 1976; Bini-Smaghi, 1991; Cushman, 1983; De Grauwe & Verfaille, 1988; Gros, 1987; Hasan & Khan, 1994; Hassan, Fausat, & Baba, 2016; Kandil, 2008; Kappler, Reisen, Schularick, & Turkisch, 2013; Khan, 1995; Kohler, Manalo, & Perera, 2014; Masih, Liu, & Pervaiz, 2018; Nawaz & Ghani, 2018; Yang, 1997). Numerous studies in recent years have provided compelling evidence regarding the effect of exchange rate uncertainty on the EG of developing economies (Algaeed & Algethami, 2022), Saudi Arabia (Khan, 2021), Bangladesh (An, Binh, & Cam, 2020), and ASEAN (Matthew et al., 2021).

The current study focuses on the South Asian region, which is home to 1.891 billion people. It makes up one-fourth of the world's population and must cope with several challenges in terms of poverty, energy demand, low saving rate, and macroeconomic stability (Devarajan & Nabi, 2006; Farrington & Clarke, 2006). The South Asian "region lags behind other countries in terms of many socio-economic factors compared to world standards, yet, in the past few decades, the region has emerged as a potential area for economic development and growth (Most & De Berg, 1996). The "region has registered an annual growth rate (average) of 5.4 % compared to the 3.1% growth rate of the world average in the last five decades (Bank, 2017).

Earlier studies that investigated the implications of exchange rate uncertainty for domestic output in South Asian economies (Ahmad, Ahmad, & Ali, 2013; Hamid & Mir, 2017; Hooy & Choong, 2010; Iqbal, Khan, & Nosheen, 2019; Iqbal, Nosheen, Panezai, & Salahuddin, 2021; Javed & Farooq, 2009; Nawaz, 2012; Shahbaz, Islam, & Aamir, 2012). However, these studies were based on the assumption of symmetry between the exchange and economic growth. The assumption of symmetry between the exchange rate and EG is either overly restrictive or overly simplified. However, in the recent period, many studies have reported evidence of asymmetric effects while estimating the impact of exchange rate changes on domestic output and other economic indicators (Bahmani-Oskooee & Bahmani, 2015; Bahmani-Oskooee & Fariditavana, 2015; Bahmani-Oskooee & Mohammadian, 2017; Chishti, Iqbal, Mahmood, & Azeem, 2020; Iqbal, 2020; Iqbal, Aziz, & Nosheen, 2020, 2022; Iqbal, Nosheen, & Rehman Panezai, 2021; Katrakilidis & Trachanas, 2012; Najibullah, Iqbal, & Nosheen, 2021; Nusair, 2017; Shin, Yu, & Greenwood-Nimmo, 2014).

This study interrogates the question of whether there is evidence of an asymmetric relationship between exchange rate and EG in the case of South Asian economies. The present study adds to the body of literature in several ways. First, the current study adds to the body of knowledge by addressing both the symmetric and asymmetric effects of exchange rates on the EG of South Asian economies by separating the exchange rate into appreciations (adverse shocks) and depreciations (positive shocks) because EG responds to shocks differently than the real exchange rate. Second, the study uses a consistent approach adopted by Granger & Yoon (2002); Hatemi-J, (2012); Najibullah, Iqbal, Nosheen, et al. (2021); Olaniyi (2019) to decompose exchange rate into appreciation and depreciation. This approach helps in separating the effects of positive changes from

the effects of adverse changes since economic agents in international markets tend to react differently to appreciation and depreciation. The method also aids in determining whether real depreciation or real appreciation, as well as their magnitudes, have different effects. Third, region-wise studies that examine the impact of exchange rates on EG tend to obscure the true relationship between the two variables because the results may differ from country to country due to differences in political, economic, and geographical structures. Thus, the current study investigates both the symmetric and asymmetric effect of exchange rates on EG for selected South Asian economies separately.

Method

Researchers have included different variables for examining the effect of the real effective exchange rate on domestic production. Based on data availability, the study covers a period from 1980 to 2019 using annual data for the selected five economies. Following Bahmani-Oskooee & Aftab, (2017); Bahmani-Oskooee et al. (2018), this study introduces two policy variables along with other control variables as below:

$$LnY_t = a + bLnM_t + cLnG_t + dLnREX_t + \varepsilon_t \quad (1)$$

In the given model, Y represents the real GDP for Pakistan, G denotes the real government spending of a country, M shows the real money supply by the country's central bank, and REX denotes the real effective exchange rate. The real effective exchange rate variable is defined so that a REX fall indicates devaluation. The positive coefficient of REX defines the contraction in the gross domestic product; however, the negative coefficient of REX means the expansion of domestic production. In the case of expansionary policies, we say that the estimates of b and c will be positive. We extend this equation by incorporating two more variables, i.e. oil prices and daily wage. The justification for including these two variables is that other studies have assumed perfect aggregate supply. The model takes the following form in the long run;

$$LnY_t = a + bLnM_t + cLnG_t + dLnREX_t + eLnOP_t + fLnW_t + \varepsilon_t \quad (2)$$

To introduce asymmetry in model, the real exchange rate is divided between depreciation (positive shock) and appreciation (negative shock) from equation-2. The real effective exchange rate is replaced with the notation POS and NEG, respectively. Both POS and NEG are the appreciations and depreciation of each country's currency as below:

$$POS_t = \sum_{j=1}^{t} \Delta lnREX_j^+ = \sum_{j=1}^{t} \max(\Delta lnREX_j, 0) \quad (3)$$
$$NEG_t = \sum_{j=1}^{t} \Delta lnREX_j^- = \sum_{j=1}^{t} \min(\Delta lnREX_j, 0)$$

By introducing these two variables POS and NEG, a new model is as below:

$$LnY_t = a + bLnM_t + cLnG_t + dLnPOS_t + eLnNEG_t + fLnOP_t + gLnW_t + \varepsilon_t \quad (4)$$

Model equation-(4) is no longer linear because it has two new time series variables in model, i.e. POS & NEG, which makes the adjustment process nonlinear. However, model (2) is said to be a linear ARDL model. After estimating (4), if cointegration is established between variables, it can be infered the four kinds of asymmetry. To begin with, short-run asymmetry is built up in the case of $\hat{a}_{4k}^{+} \neq \hat{a}_{4k}^{-}$ for all k. Secondly, long-run asymmetry is built up in case $\hat{\beta}_3^{+} \neq \hat{\beta}_3^{-}$. Finally, the dynamic multipliers pattern captures the adjustment asymmetry. It applies the Wald test for the concreteness of the results. However, adjustment asymmetry is judged by dynamic movements.

Results and Discussion

The present study investigates the impact of exchange rates on EG for selected South Asian economies such as Pakistan, India, Bangladesh, and Sri Lanka. For this purpose, the study applies both the linear and nonlinear ARDL model to show the symmetric and asymmetric effect of the exchange rate on the EG of South Asian economies. Since the present study is based on annual data, it allows the maximum three lags. The study follows Akaike's Information Criterion (AIC) for lag selection to determine the cointegration relationship among the variables. Results of the bound test are presented in table-1 through table 8, which indicate the outcome of the cointegration relation.

We also present the empirical results for each country based on the linear and the nonlinear ARDL. Each consists of three panels. Panel A provides the short-run coefficient estimates, and Panel B shows the long-run coefficient estimates, while in Panel C, we report diagnostic statistics.

We start by looking at the results of both the symmetric and asymmetric approaches. Tables 1–8 show that, in the cases of Pakistan, India, Bangladesh, and Sri Lanka, almost all independent variables have the expected signs based on the results that rely on the assumption of symmetry. The F-stat values confirm the presence of long-run cointegration both in the linear and nonlinear models for the selected countries.

In the case of the selected economies, the independent variable has almost expected signs. For example, government expenditure, real effective exchange rate, and real wage significantly impact the EG in the short run. While oil price and monetary policy do not have a significant impact on EG in the short run., However, other independent variables significantly impact EG in the long run, except for real wages and oil prices. The short-run and long-run coefficients of the effective exchange rate indicate that appreciation is helpful to the economy in the short run but in the long run, appreciated currency tends to negatively affect the competitiveness of exports which in turn has negative implications for EG. In the case of India, the real effective exchange rate has a significantly negative impact on EG in the short run, but in the long run, it has a positive and significant impact on EG in the case of India. In the case of Sri Lanka, the findings show that the real effective exchange rate has an insignificant impact on EG in the short run, but in the long run, it has a negative and significant impact on EG in the case of Sri Lanka. Other independent variables have expected signs, such as government expenditure, monetary policy, and oil prices. For example, government expenditure and monetary policy have a positive and significant impact on EG in the short and long run. However, in the case of oil prices, it has a significantly negative impact on EG both in the short and long run.

Similarly, in the case of Bangladesh, the independent variables come up with expected signs. However, an increase in oil prices has no significant impact in the short run, while in the long run, it tends to affect the economy of Bangladesh negatively, mainly because of an increase in production cost. The findings are in line with the studies by Aguirre & Calderón (2005); Dhasmana (2015); Rahman & Serletis (2009), which discovered that compared to appreciations, output responds favourably to exchange rate appreciation more so than depreciation.

Tables 2, 4, 6 and table-8 present the empirical results based on nonlinear ARDL for Pakistan, India, Sri Lanka and Bangladesh. The result indicates that when it allows the asymmetry in the empirical model, i.e., when the model desegregated the exchange rate variable into the positive and negative exchange rate, it indicates an irregular pattern, i.e., unlike the symmetric approach, the positive exchange rate tends to affect the EG positively in the short run but negatively in the long run. Similarly, the negative exchange rate tends to affect EG negatively in the short run but positively in the long run. Thus the empirical results indicate the evidence of asymmetric effect in the case of the exchange rate and growth relationship, which is confirmed by the Wald-S and Wald-L statistics in the selected four South Asian economies. The finding is in line with previous studies such as those Abbasi & Iqbal (2021); Bahmani-Oskooee et al. (2018); Bahmani-Oskooee & Baek (2020), who reported evidence of asymmetric results.

Regarding the validity of the results, the study presents the diagnostic tests for both linear ARDL and nonlinear ARDL-based models. It shows that all tests satisfy the standard validity conditions. For example, the ECM terms are negative and significant in both tables, which shows that both the linear and nonlinear models are stable. Similarly, The RESET, the Lagrange Multiplier (LM), and CUSUM and ($CUSUM^2$) test reported at the bottom of Panel C of table-1 through table-8 confirm that the model is correctly specified (e.g., as well as there is no autocorrelation problem. It also shows that the models are stable. The graphical representation of each test here will make the process cumbersome; therefore, it presents the symbol of 'S' for stable coefficients and the 'US' for unstable coefficients at 5% significance levels. While the Wald-S and the Wald-L indicate evidence of asymmetric effect both in the short and long run. The empirical results confirm the evidence of asymmetric results in the case of the selected four economies indicating that EG responds in a different way to changes in appreciation and depreciation. Overall results in the case

of all South Asian economies corroborate the findings of other studies of the region such as Ahmad et al. (2013); Hamid & Mir (2017); Hooy & Choong (2010); Javed & Farooq (2009); Nawaz (2012); Shahbaz et al. (2012).

Table 1. Estimates of Linear Model (Pakistan)

Panel A: Short-run Coefficient Estimates						
Lag Order	0	1	2	3		
ΔLnY		0.45**				
		(-2.85)				
ΔLnG	0.08**					
	(-2.53)					
ΔLnM	0.12					
	(-1.68)					
ΔLnREX	0.23**					
	(-3.44)					
ΔLnPO	0.09					
	(-1.48)					
ΔLnW	-0.07**					
	(-2.03)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LNPO	LNW
3.61**	0.09	0.05**	0.71**	0.37*	0.18**	-0.04**
-4.65	(-1.56)	(-3.76)	(-3.11)	(-1.66)	(-2.47)	(-3.94)
Panel C: Diagnostics						
ECM-1		LM	RESET	R2	CUSTOM	(CUSUM)²
-0.36**		5.14	0.84	0.58	S	(S)
(-4.26)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 2. Full Information Estimates of Nonlinear Model (Pakistan)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3			
LnY		1.13**	0.05				
		(-4.14)	(-0.86)				
LNG	0.15	-0.07	1.16				
	(-0.49)	(-1.35)	(-2.71)				
LnM	0.15	0.024**	0.22**				
	(-1.23)	(-4.61)	(-2.51)				
LnW	-0.09*	0.18	-0.07**				
	(-1.85)	(-0.86)	(-2.42)				
LPO	0.04	-1.09**	0.54				
	(-1.03)	(-3.84)	(-1.40)				
POS	0.08*	0.30**	-0.19*				
	(-1.86)	(-2.5)	(-1.77)				
NEG	-0.53**	-1.3	0.05**				
	(-2.00)	(-1.25)	(-4.38)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
3.73**	0.03**	0.01	0.22**	0.09**	0.06**	0.03**	0.41**
(-6.12)	(-7.63)	(-0.43)	(2.72)	(-2.32)	(-3.41)	(-4.63)	(4.90)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj-R square	CUSTOM	(CUSUM)²	Wald-S	Wald-L
-0.08**	2.59	0.55	0.6	S	(S)	9.08**	6.14**
(-3.34)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 3. Estimates of Linear Model (India)

Panel A: Short-run Coefficient Estimates						
Lag Order	0	1	2	3		
ΔLnY		0.36**				
		(-1.97)				
ΔLnG	0.06**					
	(-3.52)					
ΔLnM	0.03*					
	(-1.83)					
ΔLnREX	-0.14*					
	(-1.76)					
ΔLnPO	-0.16*					
	(-1.88)					
ΔLnW	-0.02					
	(-1.02)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LPO	LnW
3.45**	0.02**	0.08**	0.33**	0.05**	-0.17**	-0.07
(-4.76)	(-5.22)	(7.82)	(4.11)	(3.81)	(-2.05)	(-0.97)
Panel C: Diagnostics						
ECM-1	LM	RESET	Adj-R square	CUSTOM	$(CUSUM)^2$	
-0.68**	6.58	0.67	0.67	S	S	
(-7.96)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 4. Full Information Estimates of Nonlinear Model (India)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3			
LnY		1.17**	0.09				
		(-4.06)	(-0.82)				
LNG	0.28**	-0.04	0.06				
	(-2.69)	(-0.14)	(-1.5)				
LnM	0.04	0.24**	0.01				
	(-1.35)	(6.32)	(-1.53)				
LnW	-0.01	0.01	-0.12				
	(-0.34)	(-0.11)	(-1.65)				
LPO	-0107**	-0.04**	-0.01				
	(-3.02)	(-2.87)	(-1.60)				
POS	0.15	0.23	-0.06				
	(-1.45)	(-1.40)	(-0.85)				
NEG	-0.42	-0.27	-0.14				
	(-1.01)	(-1.34)	(-1.33)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
2.52**	0.02**	0.01*	0.33**	0.09**	0.06**	0.02**	0.71**
(-6.13)	(-5.6)	(1.82)	(3.53)	(-3.23)	(-4.70)	(5.62)	(-2.94)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj-R square	CUSTOMS	CUSTOM	Wald-S	Wald-L
-0.08**	3.49	0.44	0.7	S	S(S)	4.60**	9.08**
(-2.27)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 5. Estimates of Linear Model (Sri Lanka)

Panel A: Short-run Coefficient Estimates						
Lag Order	0	1	2	3		4
ΔLnY		0.26*				
		(-4.86)				
ΔLnG	0.18**					
	(-4.63)					
ΔLnM	0.14**					
	(-2.18)					
ΔLnREX	0.43					
	(-1.02)					
ΔLnPO	-0.17*					
	(-1.78)					
ΔLnW	-0.19					
ΔLnY	(-1.03)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LPO	LnW
3.51**	0.17**	0.16**	0.91**	0.39*	-1.18*	-0.12**
(-2.56)	(-1.65)	(3.95)	(2.31)	(2.55)	(-1.93)	(-3.72)
Panel C: Diagnostics						
ECM-1	LM	RESET	Adj-R square	CUSTOM	(CUSUM)2	
-0.35**	6.12	0.82	0.62	S	(S)	
(-2.45)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 6. Full Information Estimates of Nonlinear Model (Sri Lanka)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3	4		
LnY		1.13**	0.16				
		(-2.12)	(-0.85)				
LNG	0.16**	0.19*	0.15*				
	(-2.27)	(-1.86)	(-1.94)				
LnM	0.16**	0.16**	0.15*				
	(-2.43)	(-2.51)	(-1.76)				
LnW	-0.17*	0.18	-0.19				
	(-1.86)	(-0.85)	(-1.24)				
LPO	-0.12	-1.07**	0.62				
	(-1.03)	(-3.82)	(1.22)				
POS	-0.18*	-0.30**	-0.17				
	(-1.85)	(-2.66)	(-1.69)				
NEG	0.63**	-1.3	0.16*				
	(2.14)	(-1.46)	(-2.38)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
3.93**	0.13**	0.11**	0.44*	0.17*	-0.15**	0.13**	0.21**
(-5.14)	(-3.53)	(4.23)	(4.94)	(-4.34)	(-3.2)	(-2.53)	(2.71)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj- R-square	CUSTOM	CUSUM²	Wald-S	Wald-L
-0.18**	4.67	0.66	0.6	S	(S)	6.5**	7.08**
(-3.32)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 7. Estimates of Linear Model (Bangladesh)

Panel A: Short-run Coefficient Estimates						
Lag Order		0	1	2	3	4
ΔLnY			0.05*			
			(-1.76)			
ΔLnG	0.05**					
	(7.04)					
ΔLnM	0.07**					
	(2.63)					
ΔLnREX	-0.12*					
	(-1.95)					
ΔLnPO	-0.12					
	(-0.88)					
ΔLnW	-0.14					
	(-1.04)					
Panel B: Long-run Coefficient Estimates						
Constant	Trend	LNG	LnM	index	LPO	LnW
3.26**	0.14**	0.18**	0.03**	-0.16*	-0.16*	-0.19
(-2.95)	(6.44)	(4.84)	(5.11)	(-1.80)	(-1.86)	(-0.79)
Panel C: Diagnostics						
ECM-1	LM	RESET	Adj-R square	CUSTOM	$(CUSUM)^2$	
-0.08**	5.68	0.09	0.57	S	S	
(-9.75)						

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Table 8. Full Information Estimates of Nonlinear Model (Bangladesh)

Panel A: Short-run Coefficient Estimates							
Lag Order	0	1	2	3	4		
LnY		1.19**	0.17				
		(-2.05)	(-0.84)				
LNG	0.11**	0.12**	0.15**				
	(3.57)	(2.12)	(2.67)				
LnM	0.12**	0.42**	0.15**				
	(3.36)	(5.54)	(2.84)				
LnW	0.11*	0.11*	0.14				
	(1.82)	(1.81)	(1.56)				
LPO	-0.19*	-0.12*	-0.11				
	(-1.94)	(-1.89)	(-1.50)				
POS	-0.16**	-0.40**	-0.15				
	(-3.86)	(-3.21)	(-0.86)				
NEG	-0.24**	-0.43*	-0.32				
	(-2.01)	(-1.72)	(-1.48)				
Panel B: Long-run Coefficient Estimates							
Constant	Trend	LNG	LnM	LnW	LPO	POS	NEG
4.64**	-0.14**	0.11**	0.33**	-0.17	-0.15*	0.14**	0.19**
(5.13)	(-3.51)	(2.94)	(3.63)	(-1.43)	(-1.91)	(-2.54)	(5.72)
Panel C: Diagnostics							
ECM-1	LM	RESET	Adj- R-square	CUSTOM	$CUSUM^2$	Wald-S	Wald-L
-0.18**	3.27	0.22	0.4	S	S	2.5	7.08**
(-4.49)							

The absolute values for t-ratios are inside the parenthesis. *, ** indicates the significance of outcome at 10% and 5% levels of significance, respectively."

Conclusion

Previous studies focused on the exchange rate and growth nexus were supposed to have a limitation: they all assumed a symmetric approach to cointegration. Hence the findings of these studies are supposed to have been masked by the restricted assumption. The present study, therefore, aims to investigate both the symmetric and asymmetric effect of exchange rate changes on the economic growth of the selected SAARC economies such as Pakistan, India, Sri Lanka, and Bangladesh. The empirical results confirm the asymmetric effect in two ways. First, in all the selected economies, it finds significant evidence that exchange rate changes behave differently in case of the short run as well as in the long run, which is in line with the findings of the previous studies as reflected in the J-curve phenomenon. However, the study also confirms the evidence of the asymmetric effect of exchange rate changes on economic growth in the case of all the selected economies. In all cases, positive and negative exchange rates tend to affect economic growth asymmetrically. These asymmetric effects may be due to different expectations of producers and consumers about appreciation and depreciation in terms of risk-taking behaviour. One thing which was found to be common is that in almost all the cases, the study found that expansionary fiscal and monetary policy has been beneficial to the respective economies in terms of economic boost and expansion. While in many cases, the study found that increasing oil prices affected economic growth in general in many cases. As a result was insignificant, at least in the short run, while the impact of real wages shows an insignificant impact in most cases. The results are important from a policy perspective that fiscal and monetary policy tools are crucial for economic growth. However, the exchange rate policy is sensitive to each country's situation, particularly the elasticity of exports and imports and the country's external position in terms of trade surplus and trade deficit. The findings have important policy implications. Although an appreciated currency appears to be politically appealing, it is expected to result in unnecessary import growth and a negative impact on export competitiveness, potentially leading to increased trade imbalances. While depreciation may appear to provide temporary relief in terms of economic growth. South Asia's developing economies must adhere to a market-based ER system that considers demand and supply considerations. The market-based exchange rate system is intended to protect the economy from external financial shocks and to keep the economy on a strong growth path. The study contributes to the debate that both appreciation/ overvaluation and depreciation/ undervaluation tend to end up in a different outcomes in terms of economic growth. Thus exchange rate policy needs to be used more prudently.

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APPENDIX: Data Definition and Sources"

"All data are annual for 1980-2019 and come from the International Financial Statistics of the IMF."

Variables:

GDP = index of real GDP in i^{th} South Asian economy (Pakistan, India, Sri Lanka, Bangladesh)
M = real money supply defined as real M3. The GDP deflator deflates nominal M3 figures in national currency.
G = real government spending. The GDP deflator deflates nominal data into national currency.
REX = real effective exchange rate. A decline reflects a real depreciation of the domestic currency.
PO = world crude oil (Petroleum) price index.
W = wage rate index for i^{th} selected South Asian country.

AppendixA1. Unit root tests based on ADF and Phillips-Perron unit root (PP) test

Pakistan					India			
Variable	Level.PP	Δ.PP	Level.ADF	Δ.ADF	Level.PP	Δ.PP	Level.ADF	Δ.ADF
lnY	--2.685	-3.808**	--1.904	-3.775**	--2.359	-3.539**	--2.207	-4.128**
lnM	-2.521	5.697**	-2.849	5.647**	-3.529	5.294**	-3.303	5.176**
LNG	--2.381	-5.381**	--2.691	-5.334**	--3.333	-5.000**	--3.119	-5.833**
lnREX	--3.363	-5.340**	--2.670	-5.293**	--3.308	-4.962**	--3.096	-5.789**
lnW	-2.687*	-3.105**	--0.776	-4.539**	-2.9618*	-4.443**	-2.900*	-4.683**
lnOP	--2.518	-5.691**	--2.845	-5.641**	--3.525	-5.288**	--3.299	-6.168**
lnPOS	-2.464**	-5.309**	-3.654**	-3.280**	--2.050	-3.074**	--2.918	-3.586**
lnNEG	-3.124*	-4.160**	-3.1002*	-5.478**	-3.1736**	-6.260**	-3.712*	-5.552**
Bangladesh					Sri Lanka			
	Level.PP	Δ.PP	Level.ADF	Δ.ADF	Level.PP	Δ.PP	Level.ADF	Δ.ADF
lnY	--2.022	-4.954**	--2.831	-4.635**	--2.649	-4.046**	--2.467	-4.194**
lnM	3.025*	5.412**	-4.235	5.935**	-3.963	6.053**	-3.691	6.274**
LNG	--2.857	-5.000**	--4.000	-5.550**	--3.743	-5.717**	--3.486	-5.926**
lnREX	--2.836	-6.947**	--3.970	-5.501**	--3.715	-5.673**	--3.459	-5.881**
lnW	-2.824*	-4.020**	-2.154*	-4.890**	-2.080*	-4.649**	-3.006*	-4.710**
lnOP	--3.022	-5.403**	--4.230	-6.927**	--3.958	-5.046**	--3.686	-5.267**
lnPOS	-3.022**	-5.404**	-3.231**	-6.928**	-3.959**	-5.046**	--3.687	-4.268**
lnNEG	-2.452	4.007**	-3.433	5.621**	-3.212	4.906**	-2.991	4.085**

Notes: Level ADF and Δ.ADF denote the level and first difference of the augmented Dickey-Fuller unit root test; Where Level PP and Δ.PP denote the level, and first difference of the Phillips-Perron unit root test; * and ** denote rejection of the null hypothesis of no unit root at 10% and 5% significance level, respectively. None of the variables is integrated of I(2).

Economic Journal of Emerging Markets, 14(2) 2022, 176-188

EJEM
Econ.J.Emerg.Mark.

Economic Journal of Emerging Markets
Available at https://journal.uii.ac.id/jep

Foreign direct investment and economic growth nexus in ECOWAS: The leveraging effect of anti-corruption

Grace Nkansa Asante[1], Kofi Kamasa[2*], Myles Patrick Bartlett[3]

[1,3]Department of Economics, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
[2]Department of Management Studies, University of Mines and Technology, Tarkwa, Ghana
[*]Corresponding Author: kofikamasa@hotmail.co.uk

Article Info

Article history:
Received 1 February 2022
Accepted 23 September 2022
Published 5 October 2022

JEL Classification Code:
F43, O43, O55

Authors' emails:
ofori35@yahoo.com
mylesbart@gmail.com

DOI: 10.20885/ejem.vol14.iss2.art3

Abstract

Purpose — This paper sought to investigate the interactive effect of corruption and FDI on economic growth in the Economic Community of West African States (ECOWAS) region empirically.

Methods — With panel data spanning 2000–2019 across 15 ECOWAS countries, this paper estimates its results by employing the system-GMM estimator, which combines a system of regressions in difference and in levels to resolve the problem of endogeneity.

Findings — Results reveal that while FDI independently spurs economic growth, control of corruption has no direct effect on growth in the region. The interactive effects reveal the complementarity between FDI and control of corruption in promoting economic growth in the ECOWAS region. The growth effect of FDI is larger and stronger given an improvement in the control of corruption across the 1st, 5th, 10th, and 25th percentiles.

Implication — To improve investor confidence, bolster FDI inflows and optimize its beneficial impacts on economic growth, this paper calls for measures to increase transparency and stronger political commitment to strictly investigate, prosecute and punish corruption in the ECOWAS region.

Originality/value — Although foreign direct investment (FDI) to host countries have been shown in the literature to be a crucial driver of economic growth, little is known about how anti-corruption measures affect the FDI-growth relationship. This paper contributes to policy by providing empirical evidence to bridge this gap.

Keywords — FDI, corruption, economic growth, GMM, ECOWAS

Introduction

Economic growth has been of great importance for many economies, and the issue persists in today's global economies. Trade and investments are increasingly expanding in this period of financial globalization (see Broner et al., 2016; Poelhekke, 2016). This has resulted in creating multinational ties between countries irrespective of the stage of growth or development. Foreign direct investment (FDI) is viewed as a strategic means of external financing (see UNCTAD, 2019), technology transfer (see Osano & Koine, 2015), deepening trade linkages (Freund & Pierola, 2012; Moran, 2014), raising employment capacities and wage levels (Javorcik, 2015; Peluffo, 2015) in developing countries. From a theoretical strand, the endogenous growth model, which puts forward a possibility of a spillover from FDI to residential industries and a positive impact on

P ISSN 2086-3128 | E ISSN 2502-180X

productivity (Barro & Sala-i-Martin, 1997), have been used to provide support for policies in this direction. However, Kokko (1994) observed that the connection between FDI spillovers and domestic companies could differ across industries because foreign firms are likely to operate in environments that offer single opportunities for them to benefit. This observation implies that not every country benefits from the spillover effect of FDI inflows. Nevertheless, FDI supports economic growth in developing economies since they are unable to drive growth with domestic savings. Owing to low levels of domestic savings in developing economies, most economies are divided between creating enabling environments at no cost to attract FDI or raising funds from the financial markets (which ultimately increases public debt).

FDI was previously viewed as a medium for foreign dominance in the host country, unhelpful, and inciting inappropriate technologies into developing countries. Consequentially, the import substitution policy was initially adopted by most countries as a mechanism for economic growth. However, this view has changed over the past three decades, with countries putting in policies to attract FDI to achieve sustainable growth, accelerating modernization in industrialization and improving employment conditions and living standards. For instance, in Ghana, recent policies such as 'planting for food and jobs' and 'one-district one-factory' are fertile grounds for FDI inflows. Within the ECOWAS region, the *ECOWAS Investment Policy* and the *Regional Investment Climate Scorecard* seek to promote FDI.

Just as FDI remains an important determinant of economic growth for African economies (see Gui-Diby, 2014). Ajide and Raheem (2016) note that over the past decade, the institutional climate in the African region in general and the ECOWAS sub-region in particular has been plagued by corruption, political instability, and a host of investor-unfriendly characteristics. For instance, for the 2019 Transparency International's corruption index, Ghana, Benin, Cote D'Ivoire and Nigeria were ranked 80th, 80th, 106th and 146^{th,} respectively. Economic theory suggests that high corruption levels degrade the perception of the host country's investment environment by reducing transparency, lowering investor confidence, wasting resources, and providing poor governance. Economically, corruption poses a threat due to the high costs of business operations to both the public and private enterprises in the long run. The pertinent question thus would be whether corruption play a role in FDI-Economic growth nexus.

There have been cogent theoretical foundations premising a strong association between FDI and economic growth, albeit with mixed empirical results. Extant studies have posited that the FDI-economic growth nexus is contingent on other indicators. For instance, De Mello (1999) showed that whether FDI drives the economic growth in a receiving country depends primarily on specific features such as the amount of skilled labour available. The significance of the level of human capital in the relationship between FDI and economic growth was also confirmed by Borensztein et al. (1998). Also, the development of financial systems was recognized as a prerequisite for the positive effect of FDI on growth (see Azman-Saini et al., 2010; Hermes & Lensink, 2003). Havranek and Irsova (2011) showed that the technology difference between the host and origination countries determines the impact of FDI on economic growth. On a sector-wise FDI inflow, Gönel and Aksoy (2016) concluded that the inflows of FDI to ICT and non-ICT sectors do not enhance economic growth. Bruno and Campos (2013) also showed in the metadata analysis of 1102 reports that about 44% of scientific articles found a significant and positive influence of FDI on economic growth, whilst twelve percent of the studies revealed a negative and significant impact of FDI on economic growth.

In all these, the interactions between corruption and the factors contributing to economic growth can be described as dynamic. Corruption impedes growth and deprecates economic development prospects (Farooq, Shahbaz, Arouri, & Teulon, 2013). On their part, Jalil et al. (2016) note that the role of corruption in determining FDI inflows is a long-debated issue, and there seems to be no consensus in the literature on the nature of this relationship. For instance, using an augmented gravity model, Belgibayeva and Plekhanov (2019) found evidence of greater investment inflows between countries with good control of corruption. Similarly, Habib and Zurawicki (2002) showed that corruption negatively impacts FDI and the greater the variation in the level of corruption between the donor and receiving country, the smaller the FDI inflow. On their part,

Voyer and Beamish (2004) showed that in countries, especially emerging economies, where there is no robust legal and regulatory mechanism to mitigate corruption and illegal activities efficiently, corruption reduces FDI.

On the other hand, Arif et al. (2020) showed that corruption positively and significantly impacts FDI among the BRICS countries. At the local level, Donaubauer et al. (2018) evidenced that foreign firms increase bribery among people living nearby through increased economic activity and norm transition. Also, Quazi et al. (2014) found that corruption facilities FDI in Africa. In a more recent study, Zander (2021) finds ambiguous results in that corruption is positively correlated with FDI inflows in the target country and negatively correlated with FDI inflows in the origin country. There are also studies such as Bayar and Alakbarov (2016); Bellos and Subasat (2012); Helmy (2013), who demonstrated that corruption has no significant impact on FDI. Thus, the establishment of the impact of corruption on FDI inflows becomes an empirical one.

Several studies have been untaken on FDI inflows in African economies (see Doku et al., 2017; Kamasa et al., 2020; Sakyi & Egyir, 2017; Yeboua, 2021; Zekarias et al., 2016). Despite these extant studies, not only is little attention placed on the mediation impact of corruption on the FDI-growth nexus, but ECOWAS as a region has also not been well studied in this regard. This paper thus contributes to literature and policy in two specific ways. First, it seeks to assess the impact of corruption and FDI on economic growth in the ECOWAS region. Second, it will investigate the interactive effect of corruption and FDI on economic growth in the ECOWAS region. It seeks to estimate the marginal effect of FDI on economic growth, given various thresholds of regional corruption reductions.

Methods

Data Type and Sources

The paper uses a panel data spanning 2000–2019 across 15 ECOWAS countries (Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Liberia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo). The choice of the study period was influenced by data availability on all variables. Data was sourced from the world development indicators, world governance indicators and author constructs.

Model Specification

Drawing on the empirical studies of d'Agostino et al., (2016), Pegkas (2015) and Sunde (2017), the paper specifies a linear dynamic panel model as shown in equation (1):

$$\Delta \ln y_{it} = \alpha + \delta \ln y_{it-1} + \beta_1 COR_{it} + \beta_2 FDI_{it} + \beta_3 (COR * FDI)_{it} + \gamma X_{it} + \varphi_i + \sigma_t + \varepsilon_{it} \quad (1)$$

for $i = 1, 2, 3, \ldots, N$ and $t = 2, 3, \ldots, T$

where $\Delta \ln y_{it}$ is the log difference of GDP per capita, measuring the economic growth for country i at time t. y_{it-1} is the lag of GDP per capita, capturing the initial level of development, with its coefficient δ approximating the speed of conditional convergence of income per capita to the long-run equilibrium. COR_{it} is an indicator for control of corruption, and is proxied by the index of control of corruption from the World Bank's world governance indicators. FDI_{it} is the net inflows of foreign direct investment while $(COR * FDI)_{it}$ is the interaction between control of corruption index and foreign direct investment. X_{it} is vector of other standard correlates of economic growth, including capital per worker, inflation, government expenditure as well as trade openness. φ_i *and* σ_t are country-specific and time effects respectively. ε_{it} is the error term. Table A1 (see appendix) gives a detailed definition and sources of all variables used in this paper. Given that Equation (1) is a dynamic specification, β_i and γ are short-run parameters, and their respective long-run estimates are given as $\left(\hat{\beta}_i/(1-\hat{\delta})\right)$ and as $\left(\hat{\gamma}/(1-\hat{\delta})\right)$.

The main question this paper addresses is whether corruption (the control of corruption) limits (enhances) the impact of FDI on economic growth in the ECOWAS region. The answer to this policy-relevant research question lies in the parameters β_2 and β_3, which capture the stand-

alone impact of FDI and the joint/interaction impact of corruption control and FDI on economic growth, respectively. In particular, a positive and statistically significant estimate of β_3 suggests that improvements in keeping corruption at bay strongly complement FDI in bolstering economic growth in the ECOWAS region. From Equation (1), the conditional marginal impact of FDI on economic growth as the control of corruption can be obtained by the partial derivative:

$$\frac{\partial \Delta \ln y_{it}}{\partial \mathrm{FDI}_{it}} = \beta_2 + \beta_3 * \mathrm{COR}_{\mathrm{it}} \tag{2}$$

Equation (2) is estimated and evaluated at the 1st to 99th percentile values of the control of corruption index.

Estimation Strategy

The simultaneous presence of y_{it-1} and φ_i in equation (1) signify potential endogeneity in the model since there is the correlation between the lag dependent variable and the residual. The instrumental variable (IV) regression and the GMM have conventionally been employed to deal with the endogeneity problem in models. The IV regression uses relevant exogenous variables to solve the endogeneity problems that may exist in a model. For instrument exogeneity to hold, the instrument and the error term should not be correlated, and on the other side, a strong correlation should exist between the instrument and the explanatory variable (Wooldridge, 2016). The challenge, however lies in finding exogenous instruments which completely satisfy these criteria, consequently leading to the selection of weak instruments which can produce highly biased results. Thus, in the absence of a valid instrument, this paper employs the system-GMM estimator, which combines a system of regressions in difference and in levels to resolve the problem of endogeneity in a model (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998). The system-GMM eliminates the challenge of selecting appropriate instruments

The GMM equation, as proposed by Arellano and Bond (1991), as well as Arellano and Bover (1995), is specified as

$$Y_{it} = \theta Y_{it-1} + \vartheta_0 X_{it} + \gamma_i + \alpha_{i,t} \tag{3}$$

where Y is the endogenous variable, X is a vector of exogenous variables, γ_i is unobserved country specific effect and $\alpha_{i,t}$ is the error term. The first difference is that equation (3) is taken to remove the country-specific effects. This yield

$$Y_{it} - Y_{it-1} = \theta(Y_{it-1} - Y_{it-2}) + \vartheta_0(X_{it} - X_{it-1}) + (\alpha_{it} - \alpha_{it-1}) \tag{4}$$

By formulation, the new error term $(\alpha_{it} - \alpha_{it-1})$ in equation (4) is correlated with the lagged dependent variable. Thus, the presumption that the residual is not serially correlated and the regressors are slightly exogenous is the moment condition under which the GMM panel estimator is used. This is expressed as

$$E[Y_{it} - v(\alpha_{it} - \alpha_{it-1})] = 0 \text{ for } v \geq 2; t = 3, \dots T \tag{5}$$
$$E[X_{it} - v(\alpha_{it} - \alpha_{it-1})] = 0 \text{ for } v \geq 2; t = 3, \dots T \tag{6}$$

According to Blundell and Bond (1998), this is the difference between GMM and the lagged levels of the regressors are weak instruments when the regressors are persistent over time. A two-step system-GMM estimator combines regression in differences with regression in levels to reduce the possible biases associated with the difference GMM estimator. The two-step system-GMM requires the introduction of a new moment condition as

$$E\big[(Y_{it-s} - Y_{it-s-1})(\gamma_i + \alpha_{i,t})\big] = 0 \text{ for } s = 1 \tag{7}$$
$$E\big[(X_{it-s} - X_{it-s-1})(\gamma_i + \alpha_{i,t})\big] = 0 \text{ for } s = 1 \tag{8}$$

Using these moment conditions is a GMM technique that produces accurate and efficient estimates of parameters. This estimator 's uniqueness relative to the difference GMM estimator is that it improves efficiency and avoids the weak instrument problem.

Results and Discussion

Descriptive Statistics and Correlation

As preliminary to the main results, the paper discusses the descriptive statistics and correlation for variables employed. Table 1 reports the descriptive statistics of variables in the paper. The mean income/GDP per capita was around US$1,045.7, suggesting that ECOWAS countries are, on average low-middle income countries. While the region's economies grew at an average of 4.5% per annum, income per capita grew at a much lower pace (1.7% per year), possibly due to the opposing effects of the rapidly increasing population across the region. Furthermore, net inflows of FDI to the region are generally low, accounting for less than 5% of GDP between 2000 and 2019. The relatively low average score on the control of corruption index (-0.6) – which by construction ranges from -2.5 (worst) to +2.5 (best) – reveals the endemic nature of corruption within the region.

Table 1. Descriptive statistics

Variable	Obs., N	Mean	Std. Dev.	Min	Max
GDP per capita (constant US$)	300	1045.7	741.3	273.0	3907.6
GDP growth (%)	300	4.5	4.4	-30.1	26.4
GDP per capita growth (%)	300	1.7	4.2	-31.3	21.0
FDI net inflows (% of GDP)	300	4.8	10.5	-2.5	103.3
Control of corruption	300	-0.6	0.5	-1.6	1.0
Capital per worker (constant US$)	300	417.6	447.7	6.3	2784.5
Government expenditure (% of GDP)	300	14.4	5.2	0.5	30.8
Trade (% of GDP)	300	67.5	35.6	20.7	311.4
Inflation (%)	300	5.4	6.3	-3.5	34.7

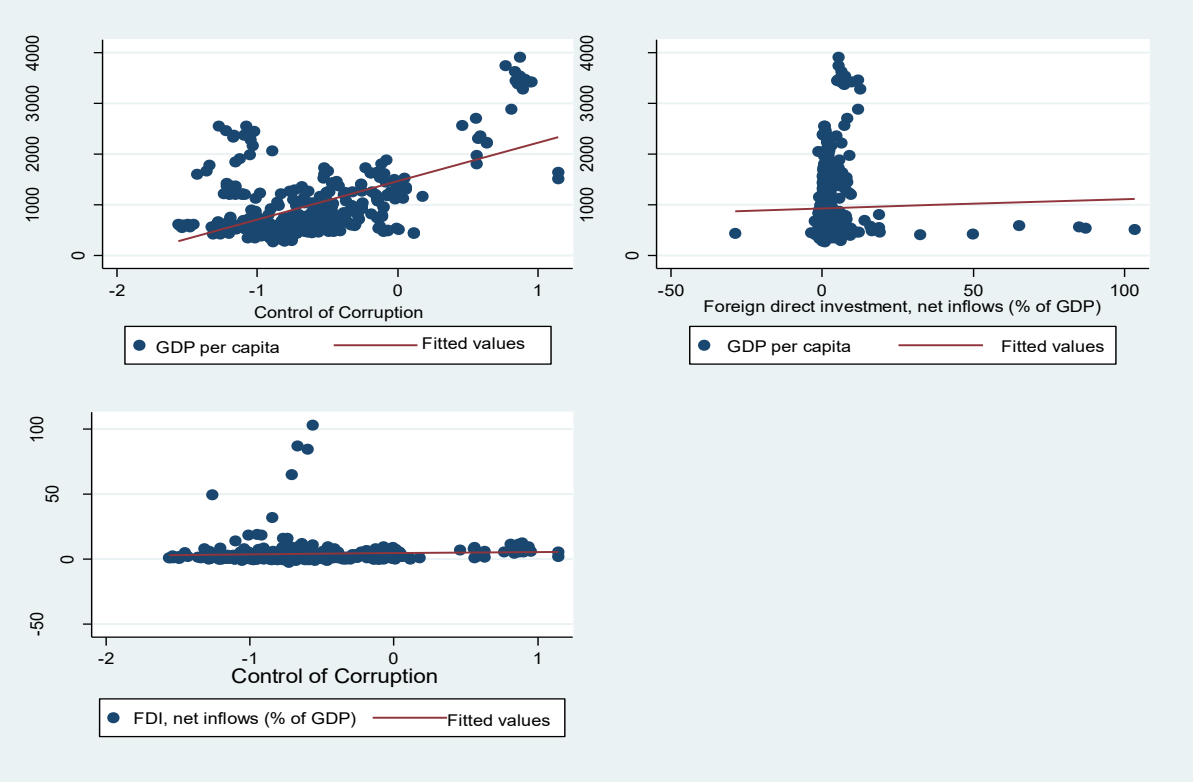
There seems to be low capital per worker in the region, with an average of US$ 417.6 over the last two decades. Ranging between 0.5% and 30.8%, government expenditure as a share GDP averaged around 14.4% within the region. On average, merchandise trade accounted for more than two-thirds of GDP (67.5%) over the period, suggesting that ECOWAS countries are widely open to international trade and highly integrated into the world economy. Lastly, the inflation rate within the region ranged between -3.5% and 34.7%, and averaged around 5.4% during the study period.

The paper used correlation coefficients to assess the degree of association among the key variables in the study, as depicted in Table 2. While the correlation between GDP per capita and FDI is weak (-0.0519) and statistically insignificant, the results show a strong positive (0.59) and significant relationship between control of corruption and GDP per capita. This implies that countries with higher control of corruption are significantly associated with higher levels of income per capita, hence higher levels of growth and development, as depicted in Figure 1. The only explanatory variable that exhibits a strong positive (0.91) and significant association with GDP per capita is capital per worker, a fundamental driver of economic growth.

Table 2. Correlation matrix

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
[1] GDP per capita	1						
[2] FDI	-0.05	1					
[3] Control of corruption	0.59***	0.05	1				
[4] Capital per worker	0.91***	0.01	0.64***	1			
[5] Government expenditure	-0.05	0.19***	0.15**	0.01	1		
[6] Trade	0.09	0.31***	0.15***	0.12**	0.05	1	
[7] Inflation	-0.02	0.11*	-0.18***	-0.01	-0.26***	0.17***	1

Note: ***, **, and * denote statistical significance at 1%, 5% and 10% levels respectively



Source: Own construct based on WDI and WGI

Figure 1: Scatter Plots of GDP per capita, FDI inflows and control of corruption

Main Results

Table 3 reports the main empirical results based on the two-step system GMM estimation. The baseline results, which estimate the isolated effects of FDI and control of corruption on economic growth, are reported in Model 1. The preferred results are presented in Model 2, which accounts for the interaction effect of these two explanatory variables of interest. In all models, some important traditional correlates of economic growth were also controlled. The short-run results from the dynamic system-GMM estimations are reported in Panel A, while their corresponding long-run estimates (generated from linear combination) are presented in Panel B.

The diagnostic statistics reported in the lower panel of Table 3 show the absence of second-order autocorrelation in both models 1 and 2. This suggests that the internally generated GMM instruments are valid. The high *p*-values of the Hansen and Sargan tests for over-identification further corroborate the validity of these instruments. Overall, these diagnostic statistics confirm that estimates from the system-GMM approach are valid and can be relied upon for policy inference.

Effects of FDI and Corruption on Growth

From baseline model 1, FDI is estimated to exert a positive and significant effect on economic growth. The magnitude of FDI's coefficient suggests that all other things being equal, a 1% increase in FDI (as a share of GDP) induces about 10.5% (obtained as $[(e^{0.1} - 1) \times 100]$) growth in income per capita in the short run. The implied long-run effect of FDI is 9.5% (obtained as $[(e^{0.091} - 1) \times 100]$. Both coefficients are significant at 5% significance level. This shows that FDI is independently an important determining factor of economic growth within the ECOWAS region. Theoretically, this growth-enhancing effect of FDI may occur through the transfer of foreign capital to complement domestic capital and the transfer of productivity-enhancing inputs, managerial skills, and technologies.

Table 3. Estimated effects of FDI and corruption on economic growth in the ECOWAS

	(1)		(2)	
	Economic Growth		Economic Growth	
Panel A: *Short-run estimates*	Coeff.	Std. Err.	Coeff.	Std. Err.
Lag of GDP per capita	-0.101**	(0.042)	-0.122***	(0.017)
FDI	0.100**	(0.050)	0.476***	(0.103)
Control of Corruption	0.027	(0.022)	-0.004	(0.025)
FDI × Control of corruption			0.528***	(0.161)
Capital per worker	0.074***	(0.021)	0.081***	(0.011)
Government expenditure	0.014	(0.013)	0.021	(0.014)
Trade openness	-0.057***	(0.019)	-0.061***	(0.013)
Inflation	-0.00013	(0.001)	0.0004	(0.001)
Constant	0.288*	(0.164)	0.374***	(0.067)
Panel B: *Long-run estimates*				
FDI	0.091**	(0.045)	0.424***	0.089
Control of Corruption	0.025	(0.020)	-0.004	0.022
FDI × Control of corruption			0.470***	0.141
Capital per worker	0.067***	(0.017)	0.072***	0.008
Government expenditure	0.013	(0.012)	0.018	0.012
Trade openness	-0.052***	(0.017)	-0.054***	0.011
Inflation	-0.0001	(0.001)	0.00004	0.001
Constant	0.261*	(0.139)	0.334***	0.055
Observations	278		278	
No. of Instruments	15		15	
p-value of AR(1)	0.105		0.033	
p-value of AR(2)	0.326		0.401	
Hansen J	7.476		1.969	
Hansen *p-value*	0.381		0.982	
Sargan test	4.78		5.13	
Sargan *p-value*	0.687		0.744	

Notes: Dependent variable: Δlog(GDPPC). With the exception of FDI, control of corruption, and inflation, all other explanatory variables are in the natural log form. Robust standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

While control of corruption is found to affect growth in income per capita positively, it is not statistically significant. A positive relationship implies that efforts to prevent public officials, elites, and private interest groups from exercising public power for private gains have the promise of spurring economic growth in the region. The positive relationship result is in line with previous studies including Cieślik and Goczek (2018) who also found that the lack of corruption has a positive and statistically significant effect on the growth rate of real per capita GDP. Other similar results include studies from Gründler and Potrafke (2019) and Ahmad et al., (2012). However, this paper's absence of statistical significance implies that such a beneficial effect may occur indirectly through other channels. Furthermore, to the extent that most countries in the region perform poorly on the control index of corruption, the lack of statistical significance may also be attributed to the low efficacy of anti-corruption and governance policies and measures.

Interaction Effect of FDI and Corruption on Economic Growth

The results in Model 2 of Table 3 explore whether anti-corruption measures enhance the growth effects of FDI within the ECOWAS region over the last two decades. This is captured by the coefficient of the interaction term (FDI × Control of corruption), which is positive and statistically significant at a 1% significant level. The results show that FDI does not only independently drive economic growth but also in conjunction with control of corruption. The estimated short-run (as well as the implied long-run) effect of FDI, which remains statistically, is 60.96%. The stand-alone (or direct) effect of the control of corruption index, albeit negative, remains statistically insignificant.

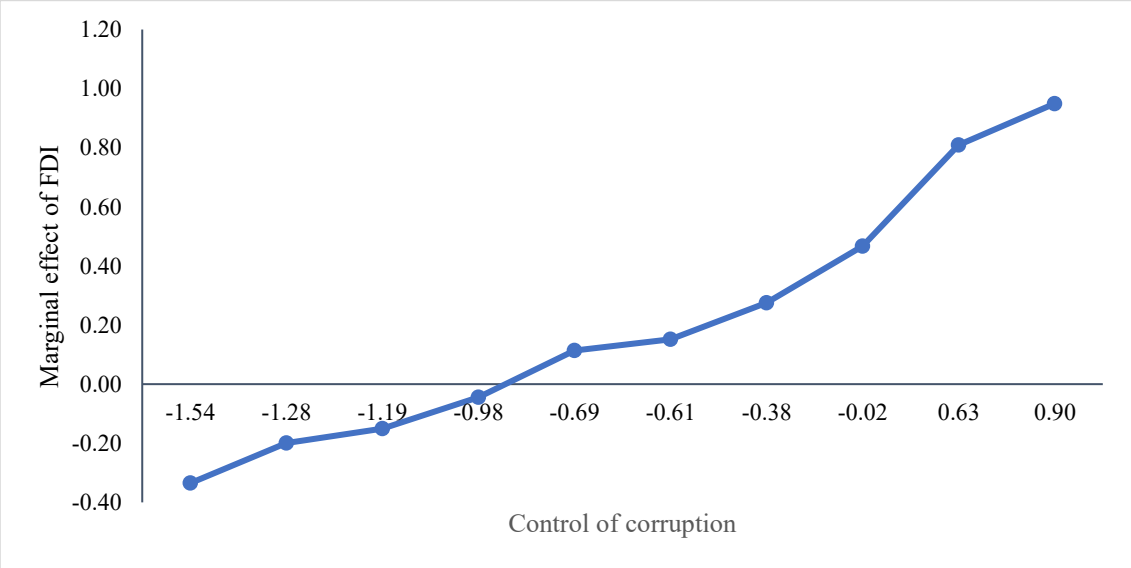
The coefficient of FDI (alone) is worth mentioning, which is larger in magnitude and statistically stronger relative to the baseline results after including the interaction term. This result intimates that control of corruption strongly enhances the impact of FDI on economic growth. This is specifically demonstrated by the estimated coefficient of the interaction term, which is larger in size than the sum of the isolated or individual coefficients of FDI and control of corruption. This outcome, which accords with our hypothesis, signifies the presence of synergy or complementarity between FDI and anti-corruption measures in propelling economic growth in the ECOWAS region. Other related studies support this finding. Malikane and Chitambara (2017) found evidence that less corruption and strong democratic institutions result in a positive impact of FDI on economic growth. Also, Hakimi and Hamdi (2017) found that corruption has a negative impact on economic growth through FDI. Finally, Yahyaoui (2021) revealed that corruption mitigates the impact of FDI on economic growth.

The marginal effect of FDI on economic growth as the control of corruption improves is presented in Table 4 and Figure 2. They are obtained by substituting the parameters of equation (2) with the corresponding estimated coefficients in Model 2 (Table 3) and evaluating the resultant expression at the 1st to 99th percentile values of control of corruption.

Table 4. The marginal effect of FDI on economic growth as the control of corruption improves

Percentile/Mean	Control of corruption	Marginal effect	Std. Err.
1%	-1.54	-0.335**	0.153
5%	-1.28	-0.199*	0.112
10%	-1.19	-0.150	0.098
25%	-0.98	-0.044	0.068
50%	-0.69	0.114***	0.034
Mean	-0.61	0.15***	0.031
75%	-0.38	0.276***	0.048
90%	-0.02	0.467***	0.100
95%	0.63	0.809***	0.202
99%	0.90	0.949***	0.244

Note: The marginal effects are calculated as $(\partial \Delta lnGDPPC/\partial FDI = 0.476 + 0.528 \times \mathrm{COR})$ from Equation (2) using the '*nlcom*' Stata command. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$



Source: Authors construct based on Table 3.

Figure 2: Marginal effect of FDI on economic growth as control of corruption improves

The growth-enabling effect of FDI turns positive, larger and strongly significant as the control of corruption improves to the 50th percentile and beyond. While the marginal effects are negative at the 1st, 5th, 10th, and 25th percentiles of control of corruption (mainly because of how

the index is measured), it is observed that the effect of FDI on economic growth increases as the anti-corruption index improves. An important policy implication of the positive trend in the marginal effect, as depicted in Figure 2, is that continual improvement in the efficacy of anti-corruption measures (hence, better control of the corruption index) can be instrumental in exploiting the beneficial effects of FDI on the economic growth of ECOWAS countries.

Intuitively, this result can be attributed to the fact that effective control of corruption strongly boosts investor confidence, lowers transaction costs, and raise economic incentives to local and foreign investors to undertake optimal investment decisions, including channelling their capital to productive sectors, and long-term, growth-enhancing projects. This result is consistent with several studies documenting the primacy of tackling corruption (and improving other aspects of institutions and governance) in fostering economic growth in Africa and other developing regions (see Bonuedi et al., 2019; Hakimi & Hamdi, 2017). For instance, Hakimi and Hamdi (2017) reported that corruption is significantly deleterious to economic growth in the Middle East and North Africa (MENA) region because it limits the effect of investment activities and foreign direct investment inflows.

Table 3 also reveals that some of the controlled variables are important determinants of economic growth within the region. In both models, the effect of the initial real GDP per capita lag is negative and statistically significant. The results in model 2 show that a 1% increase in capital per worker results in a 0.08% increase in economic growth in the short run and 0.07% implied growth in the long run. Contrary to theoretical predictions, results from the paper show that higher openness to trade acts as a drag on economic growth within the ECOWAS region. Also, while government expenditure is estimated to affect growth positively, the results show that it is not statistically significant. Lastly, the effect of inflation is negative and positive for models 1 and 2, respectively, albeit insignificant in both models.

Conclusion

FDI is considered a major contributor to economic growth in developing countries. High levels of corruption in developing countries may deter investors from committing capital to new overseas productive assets, thereby limiting the impact of FDI on economic growth. This paper aims to unearth the effect by investigating how corruption (and its control) influences the impact of FDI on economic growth. To this end, the paper employed the system GMM estimator on panel data covering 15 ECOWAS countries from 2000 – 2019. The findings show that while FDI independently exerts a significant effect on economic growth within the ECOWAS region, the control of corruption, on its own, has no direct effect on growth in the region. However, results from analyzing their interaction provide evidence that control of corruption significantly enhances the beneficial effect of FDI on the growth of economies, which depicts the presence of synergy (or complementarity) between FDI and anti-corruption measures in growth in the region. With respect to other correlates of growth, it is found that while domestic capital (per worker) spurs economic growth, trade openness drags the growth process of ECOWAS countries. Government expenditure and inflation were not found to be statistically significant in determining growth in the region.

Overall, the results show that improving the efficacy of anti-corruption measures by improving investor confidence, cutting transaction costs, and boosting economic incentives can be instrumental in attracting FDI and its beneficial effects on economic growth in the region. Thus, this paper recommends implementing policies to increase transparency in domestic and international transactions, identify potential corruption risks, and, more importantly, for strong political commitment to investigate, prosecute and punish corruption in the region. Moreover, policies must be implemented to enhance the business and investment environment, especially in regulatory frameworks, legal systems, tax systems and the financial sector, among others, to attract FDI. Lastly, complementary policies to promote domestic capital formation and diversify into value-added exports (whilst limiting import dependency) also have the potential to stimulate growth in the region further.

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Appendix

Table A1. Definition of variables and data sources

Variable	Description	Source
GDP per capita	It is gross domestic product divided by midyear population	World Development Indicators (WDI)
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars	WDI
GDP per capita growth	Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars.	WDI
FDI net inflows	It refers to direct investment equity flows in the reporting economy. It is measured as the net FDI inflow as a percentage of GDP	WDI
Control of corruption	It is proxied by the index of control of corruption from the World Bank's world governance indicators. As described in Kaufmann et al. (2010) control of corruption 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	World Governance Indicators
Capital per worker	It is the gross fixed capital formation divided by population	Author construct from WDI
Government expenditure	It reflects the extent of government participation in the economy. It is measured as all current expenditures by government for the acquisition of goods and services including payments to workers expressed in terms of GDP percent	WDI
Trade	It is the sum of exports and imports of goods and services measured as a proportion of GDP	WDI
Inflation	Inflation as determined by the consumer price index reflects the yearly percentage adjustment in the general price level of goods and services in an economy over a period of time.	WDI

Economic Journal of Emerging Markets, 14(2) 2022, 189-203

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Unemployment, total factor productivity, budget deficit, and wage share in South Africa

Juniours Marire

Department of Economics and Economic History Rhodes University, Eastern Cape, South Africa
*Corresponding author: j.marire@ru.ac.za

Article Info

Article history:
Received 27 January 2022
Accepted 27 September 2022
Published 5 October 2022

JEL Classification Code:
H6, J3, E24

DOI: 10.20885/ejem.vol14.iss2.art4

Abstract

Purpose — The paper investigated the effect of the interaction of fiscal deficits and total factor productivity (TFP) and fiscal deficits and the wage share on unemployment.

Methods — The paper applied an autoregressive distributed lag model to South African annual data from 1991-2019.

Findings — First, increases in fiscal deficits increase unemployment at all levels of TFP and wage share. Second, increases in TFP increase unemployment at different levels of fiscal deficit, but after the global economic recession, the rate of increase in unemployment declined significantly. This means that the interaction of rising TFP and fiscal deficits in South Africa, where the growth regime is profit-led and technology-driven, always results in increasing unemployment. Third, as the wage share increases, unemployment increases, at all levels of fiscal deficits, suggesting that a wage-led growth regime is no panacea to unemployment either.

Implications — The findings imply that expansionary fiscal policy does not necessarily create an economy that works for all unless active labour market institutions are set up. The findings challenge the notion that the solution to unemployment in South Africa is wage flexibility. Neither do the findings support the idea that following a profit-led growth path is a solution. A balanced mix of the two growth regimes would work.

Originality — Studies have considered the productivity-enhancing effects of structural fiscal policy, but they have not considered the possible effects of interactions between productivity, fiscal policy and wage shares. The paper addresses the gap by introducing the interactions of TFP and fiscal deficits, as well as the interaction of wage share and fiscal deficits.

Keywords — unemployment, total factor productivity, fiscal deficit, wage share

Introduction

The advent of COVID-19 has amplified the problem of unemployment in various economies, especially those with low labour absorption capacity and chronic unemployment. Developed nations adopted job preserving and income insurance strategies to prevent frictional unemployment and labour productivity erosion (Giupponi, Landais, & Lapeyre, 2022). The recession induced by the pandemic has unearthed the major fault lines of socio-economic policy that have been long in the making. South Africa has been struggling with three social evils –

P ISSN 2086-3128 | E ISSN 2502-180X

inequality, poverty, and unemployment, of which unemployment is foundational to the other two. Scholarship has identified unemployment in South Africa to have a life of its independent economic growth, structural, institutional, and resistant to market-based solutions (Schoeman & Blaauw, 2009). Causes of unemployment have been identified, not least a rigid labour market regulatory regime, a public education system that has failed to signal productivity of labour, skill intensification in the labour market, and capital intensification and automation of industrial production processes (Hirsch, 2005; Jeremy Seekings & Nattrass, 2005).

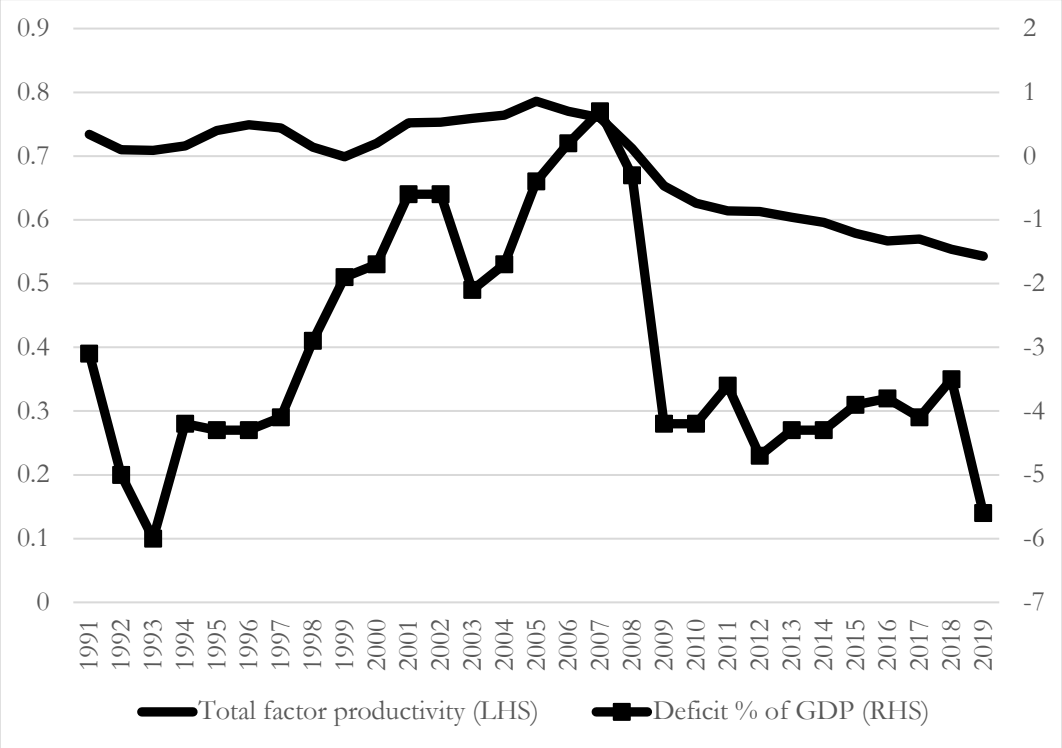
The delegation of public power to the market to deal a durable blow on unemployment, which is structural, has failed. The adoption of fiscal consolidation, which became the official fiscal strategy with the Medium Term Expenditure Framework in February 1998, has been associated with rising unemployment (Marire, 2022b). The debate has been between those who argue that fiscal consolidation creates fiscal space for investing in the long-term productivity of the economy and labour absorption capacity (Burger & Calitz, 2021; Burger, Siebrits, & Calitz, 2016) and those who say fiscal consolidation escalates unemployment, destitution, poverty and inequality (Bond, 2015; Kelton, 2015, 2020; Tanaka, 2022b, 2022a). The latter group argues for an active fiscal policy designed to provide more permanent public works job programmes than are currently in place.

The present paper focuses on the influence on unemployment of the interaction between total factor productivity (TFP) and fiscal deficits on the one hand and fiscal deficits and the wage share on the other. Some scholars suggest that fiscal deficits coupled with rising TFP reduce unemployment in the long run, especially if the wage share falls over time or wages are rigid upwards (Lama & Medina, 2019). South African scholarship has not examined the effect on unemployment of the interaction between the TFP and fiscal deficits and between fiscal deficits and the wage share. Yet, South Africa has rolled out an extensive innovation ecosystem through the National System of Innovation (NSI), with the primary goal of increasing the long-run productivity of the economy (Marire, 2022a). The considerable investment in innovation is expected to interact with fiscal deficits in ways that visibly reduce unemployment. However, the reality is that fiscal consolidation coupled with an underperforming NSI (Rooks & Oerlemans, 2005) have not left any noticeable dent in unemployment in South Africa. A careful examination of the interaction effect of fiscal deficits and TFP provides a clear understanding of how productivity-enhancing fiscal policy can play a crucial role in reducing unemployment in economies struggling with unemployment.

Source: South African Reserve Bank, https://www.resbank.co.za/en/home/what-we-do/statistics/releases/online-statistical-query

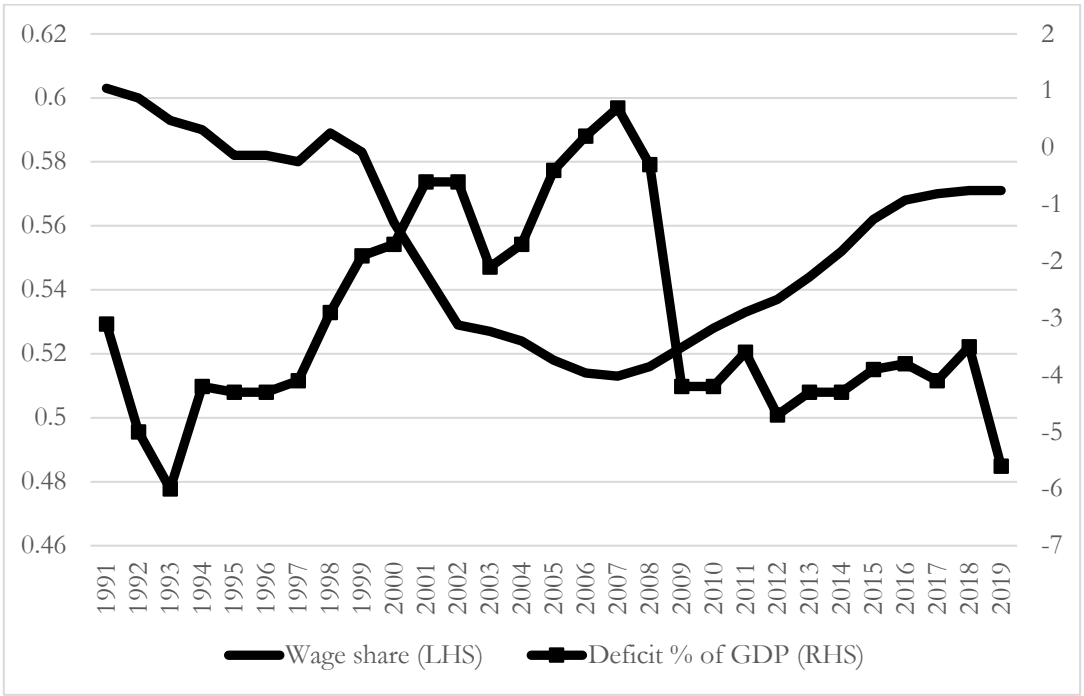
Figure 1. Unemployment and fiscal deficit for South Africa

Figure 1 shows that unemployment has not been responsive to fiscal deficits. Still, during the period of commitment to orthodox fiscal consolidation in 1998-2008, fiscal consolidation efforts managed to break the unemployment path for a small period in the early to mid-2000s. One could surmise that fiscal consolidation and the falling budget deficits associated with it provided the correct fiscal response to unemployment.



Source: South African Reserve Bank, https://www.resbank.co.za/en/home/what-we-do/statistics/releases/online-statistical-query

Figure 2. Budget deficit and the wage share

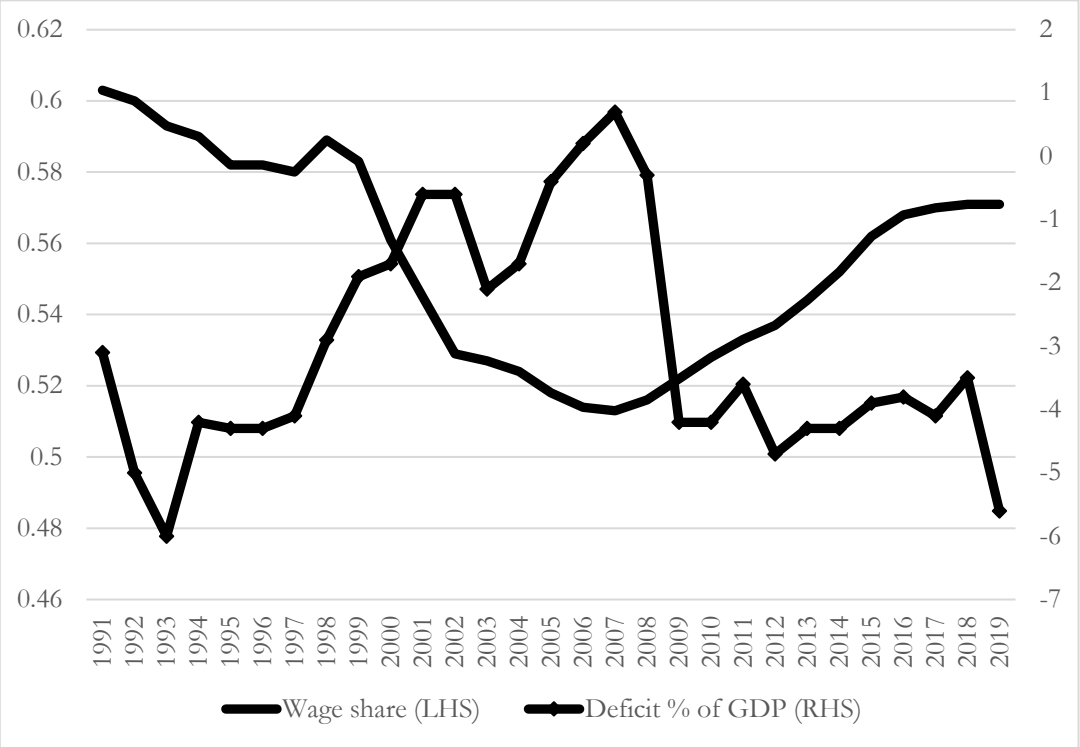


Source: South African Reserve Bank, https://www.resbank.co.za/en/home/what-we-do/statistics/releases/online-statistical-query

Figure 3. Unemployment and wage share

Figure 2 shows that periods of fiscal austerity, especially during successful fiscal consolidation in 1998-2008, coincided with falling wage share. This suggests that the public sector's contribution to the wage share is very significant; hence, efforts to contain the public sector wage bill through fiscal consolidation efforts had a huge effect on the size and trend of the wage share. From Figures 1 and 2, it is possible to surmise that fiscal consolidation coupled with the falling wage share might exert an unemployment-reducing effect. Yet, this was only plausible during the 1998-2008 period, beyond which it appears that increasing fiscal deficits coexisted with the rising wage share. Perhaps, this is through the public wage bill effect on the wage share in the post-2008 period.

Figure 3 shows that unemployment has fallen whenever the wage share fell substantially and rose when it rose. The trends agree with the conclusion, which has become a mainstream consensus, that unemployment is driven, in part, by high wage cost for business (Burger & Calitz, 2021; Burger et al., 2016). From Figure 3, it would appear as though the falling wage share reduces unemployment, suggesting that the wage regime in South Africa, in general, has been adverse to unemployment management outside the 1998-2008 period of successful fiscal consolidation.



Source: Total Factor productivity data obtained from the Federal Reserve Bank of St. Louis on https://fred.stlouisfed.org/series/RTFPNAZAA632NRUG and wage share data obtained from the South African Reserve Bank on https://www.resbank.co.za/en/home/what-we-do/statistics/releases/online-statistical-query

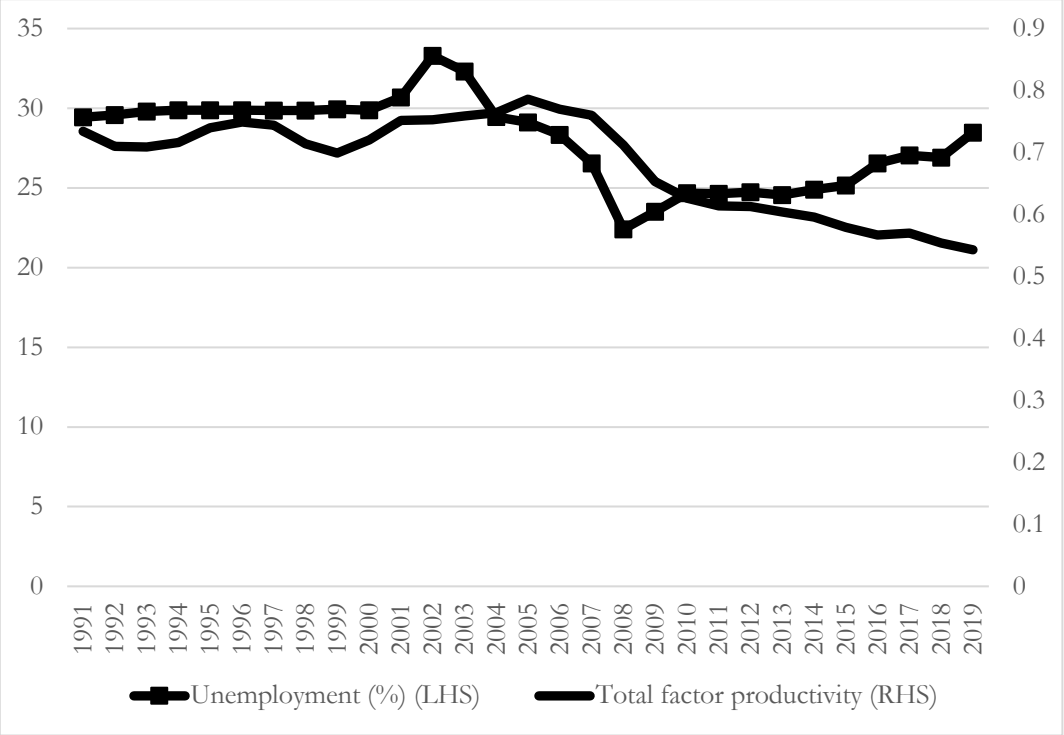
Figure 4. Total factor productivity and the wage share

Figure 4 shows that rising TFP tends to be associated with a falling wage share. Such a relationship happens if rising TFP is driven more by capital than by labour. In this sense, capital-driven productivity tends to worsen unemployment.

Figure 5 shows that between 1991 and 2004, unemployment rose with total factor productivity, while after the global financial crisis, the two variables appear to be decoupled. Unemployment is rising while total factor productivity is falling quite sharply. The 1991-2004 suggests that productivity gains might have been capital driven such that unemployment rose with productivity. After the global financial crisis, firms have been reluctant to invest, and falling productivity might be capital driven again.

The trends depicted in Figures 1 to 5 suggest a puzzle that leads to a crucial issue that the paper investigates. First, given the belief in the centrality of fiscal policy in spurring long-run growth

and development, does the interaction between fiscal deficits and TFP and the wage share influence unemployment in South Africa? Examining the interaction effects benefits the design of fiscal policy for a balanced economy that works for all and impacts unemployment perennially. To date, and to the author's best knowledge, these interaction effects have not been examined.



Source: Total Factor productivity data obtained from the Federal Reserve Bank of St. Louis on https://fred.stlouisfed.org/series/RTFPNAZAA632NRUG and wage share data obtained from the South African Reserve Bank on https://www.resbank.co.za/en/home/what-we-do/statistics/releases/online-statistical-query

Figure 5. Total factor productivity and unemployment, South Africa

Literature provides conflicting evidence on the causes of rising unemployment in South Africa. Forslund (2013) argued that the cause of unemployment in South Africa was a structural demand deficit, which a radical increase in wages could resolve. Forslund (2013)argued for a wage-led Keynesian growth process. In a recent study, Ntshwanti (2022) concurred, showing that the South African growth regime is profit-led and jobless. Similarly, Stockhammer and Onaran (2012), examining the EU, established that a wage-led growth regime undermined private investment and exports. Still, in the long term, the wage increases induced consumption effects that outweighed both the negative investment and export effects.

For this reason, like Forslund (2013), Stockhammer and Onaran (2012) advocated increased labour bargaining power and wages. In fact, Villanueva and Cárdenas (2021) found that falling wage shares in the EU co-existed with rising unemployment, thus calling into question the neoliberal stance on wage flexibility and moderation as solutions to unemployment. They showed that falling wage shares did not change Okun's law in the labour market but worsened inequality and unemployment. More distinctly, in a wage-led growth regime, the goods market overshadows the labour market, which means that the consumption effect will dominate the negative effect of rising wages on investment and exports. However, Phelps (2018) counteracted this evidence by using data for developed countries showing that Keynesian policies, in general, slackened economic growth and increased unemployment.

Neoclassical thinkers argue that what South Africa needs currently is a reduction of public sector wages, which have chewed into resources that could have been allocated to public capital investment to improve the long-run productivity of the economy and its labour absorption capacity (Burger & Calitz, 2021; Burger et al., 2016). Thinkers in this camp argue that fiscal consolidation

must be deepened and hastened to create fiscal space for investing in long-run economic performance and reduction in unemployment. Yet, critical perspectives have shown that fiscal consolidation, a neoliberal strategy, has been the root cause of unemployment in many a struggling economy (Kelton, 2020; Sawyer, 2020). Esteban-Pretel, Meng, and Tanaka (2021) and Tanaka (2022b) have shown that Japan's lost decade was driven by falling productivity and unemployment problems. Their central argument is that expansionary fiscal policy rather than fiscal consolidation played a crucial role in halting the rising unemployment. Indeed, Betti and Coudert (2022) showed the coexistence of public sector wage cuts and rising unemployment, a point that several Post-Keynesians have pointed out repeatedly also (Sawyer, 2020; Watts & Sharpe, 2013).

The generally accepted conclusion is that rising total factor productivity in the economy eventually reduces unemployment. However, Fernandez-Marquez, Fuentes, Martınez, and Vazquez (2018) found changes in total factor productivity to have mixed effects on unemployment and fiscal variables. However, Zhu (2022) confirmed that unemployment and productivity have a U-shape such that increasing productivity reduces unemployment to lower levels than the turning point. Still, beyond it, rising productivity worsened unemployment. The failure to find a clear-cut empirical relationship between productivity and unemployment is considered a challenge induced by the complexity and impossibility of establishing a simple theoretical relationship. Lama and Medina (2019) established an interaction effect between fiscal variables (e.g. spending and taxation) and total factor productivity that reduced unemployment and budget deficits, especially if wages were rigid upwards.

Similarly, Phiri and Mbaleki (2022) investigated the relationship between fiscal expenditures, revenues, and labour productivity in South Africa and found that both spending and tax variables benefited labour productivity. However, the theoretical link between taxation and labour productivity was tenuous. The effect of fiscal deficits on unemployment remains a major point of discussion, with many conflicting empirical findings. Fedeli, Forte, and Ricchi (2015) found that the OECD fiscal deficits worsened unemployment in the short and long-term. Yuan, Leiling, Saydaliev, Dagar, and Acevedo-Duque (2022) confirmed the short-term positive effect of the interaction between fiscal deficits and productivity on unemployment.

The stubborn levels of unemployment in South Africa are immune to market-based solutions and require strategic and scaled-up fiscal interventions through public works programmes. To this effect also, Modern Monetary Theory scholarship has demonstrated that a job guarantee programme, designed to be a permanent fiscal institution that accommodates a variety of skills and occupations, would always act as a super-automatic stabilizer (Esteban-Pretel et al., 2021; Kelton, 2020; Tanaka, 2022a). They argued that it would provide a long-term solution to the decent job deficit. South Africa has monopolistic and oligopolistic goods and labour markets, which tend to worsen the unemployment problem. Tanaka (2022) has shown that under such conditions of concentrated market power in factor and goods markets, continuous fiscal deficits are a sustainable solution to the problem of unemployment and weakening productivity.

South Africa is relatively integrated into the global financial system and experiences moderate to high levels of capital mobility. Despite receiving a lot of foreign direct investment, Banerjee, Galiani, Levinsohn, McLaren, and Woolard (2008) described the unemployment rate that remains relatively high, in the neighbourhood of 30 percent, as the long-run equilibrium unemployment in South Africa is non-responsive to market-induced solutions. Sadly, unemployment is refusing to climb down from the neighbourhood of 30 percent. However, for a group of advanced economies, Stirati and Paternesi Meloni (2021) confuted the notion of an economy having an equilibrium unemployment rate. Contrary to South African discourses, they found unemployment to drive the wage share down.

Pensiero (2022), however, found that increases in total factor productivity have a large positive effect on unemployment, especially when technology is capital augmenting rather than labour augmenting. Krutova, Koistinen, Turja, Melin, and Särkikoski (2021) concurred that technology-induced productivity tends to worsen unemployment, suggesting that the technology is capital-augmenting. Contrarily, Kapeliushnikov (2019) dismissed, with many empirical and theoretical arguments, the claim that technology worsened unemployment through job destruction.

Instead, in the history of technological revolutions, more jobs have been created, notwithstanding the noise in the relationship between technology and unemployment. Interestingly, Benigno, Ricci, and Surico (2015) established a puzzling pattern in US data that showed that unemployment had been rising while productivity had been rising. However, they demonstrated that the volatility of total factor productivity had a strong positive association with unemployment. This relationship overshadowed the negative association between unemployment and total factor productivity.

Methods

Empirical Model

Fiscal deficits often have lagged effects on other economic variables. This is particularly true because of the existence of policy lags such as recognition, reaction, implementation and impact lags. Total factor productivity (TFP) changes have a similar tendency to have a lagged effect on other economic variables dependent on it, such as unemployment. Based on this motivation, an autoregressive distributed lag model provides an essential framework for examining the effect of fiscal deficits and TFP on unemployment. Further, the ARDL model allows for modelling both I(0) and I(1) variables in the same regression. The ARDL (p, q, r, m, v, z) model is specified as follows:

$$unemployment_t = \beta_0 + \sum_{i=1}^{p} \beta_i unemployment_{t-i} + \sum_{j=1}^{q} \alpha_j deficit_{t-j} + \sum_{h=1}^{r} \vartheta_h TFP_{t-h} + \sum_{k=1}^{m} \vartheta_k (deficit * TFP)_{t-k} + \sum_{l=1}^{v} \vartheta_l wageshare_{t-l} + \sum_{v=1}^{z} \vartheta_v (wageshare * deficit)_{t-v} + \varepsilon_t \quad (1)$$

In Equation (1), *p, q, r, m* and *v* are optimal lag lengths determined by the Schwarz information criterion (SIC). A number of factors informed the choice of the SIC, namely a small sample, the SIC being superior to other criteria in small samples and the fact that it determined a model whose residuals approximated the Gaussian process (Cho, Greenwood-Nimmo, & Shin, 2022; Nkoro & Uko, 2016). The error term, ε_t, is assumed to be identically and independently distributed with a mean of zero and a constant variance. A priori, fiscal deficits are expected to have mixed effects – reducing unemployment in the short run and increasing it in the long run (Marire, 2022b). The wage share has a positive effect on unemployment; TFP has a negative effect, and the interaction effect has a negative effect.

After performing an F-bounds test for cointegration on (1) and establishing a cointegrating relationship, an ARDL error correction representation can be estimated. The ARDL bounds test model can be specified as:

$$\Delta unemployment_t = \beta_0 + \sum_{t=1}^{p} \beta_i \Delta unemployment_{t-i} + \sum_{j=1}^{q} \alpha_j \Delta deficit_{t-j} + \sum_{h=1}^{r} \vartheta_h \Delta TFP_{t-h} + \sum_{k}^{m} \omega_k \Delta (deficit * TFP)_{t-k} + \sum_{l}^{v} \gamma_l \Delta wageshare_{t-l} + \varphi_1 unemployment_{t-1} + \varphi_2 deficit_{t-1} + \varphi_3 TFP_{t-1} + \varphi_4 (deficit * TFP)_{t-1} + \varphi_5 wageshare_{t-1} + \varepsilon_t \quad (2)$$

The coefficients, $\varphi_1, \varphi_2, \varphi_3, \varphi_4, and\ \varphi_5$ are error correction long-run coefficients, and $\beta_i, \alpha_j, \vartheta_j, \omega_k, and\ \gamma_l$ are short-run coefficients. The ARDL F-bounds test is applied to the joint hypothesis that $\varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = 0$. If the observed F exceeds the upper bound critical F value of the bounds test, there is a long-run relationship; otherwise, there is none.
In turn, the ARDL error correction representation can be specified as:

$$\Delta unemployment_t = \beta_0 + \sum_{t=1}^{p} \beta_i \Delta unemployment_{t-i} + \sum_{j=1}^{q} \alpha_j \Delta deficit_{t-j} + \sum_{h=1}^{r} \vartheta_h \Delta TFP_{t-h} + \sum_{k}^{m} \omega_k \Delta (deficit * TFP)_{t-k} + \sum_{l}^{v} \gamma_l \Delta wageshare_{t-l} + \theta ECT_{t-1} + \varepsilon_t \quad (3)$$

In (3), we replace $\varphi_1 unemployment_{t-1} + \varphi_2 deficit_{t-1} + +\varphi_3 TFP_{t-1} + \varphi_4 (deficit * TFP)_{t-1} + \varphi_5 wageshare_{t-1}$ with θECT_{t-1} whereby θ is a measure of the speed of adjustment to the long run and ECT is the error correction term. For convergence to the long run, $\theta \in (-2, 0)$.

Since the model involves continuous variables interactions, interpreting the estimated results will follow the calculus approach (Kam & Franzese, 2007). For example, the effect of fiscal deficit on unemployment will have to be estimated from Equation (1) thus,

$$\frac{\partial(unemployment_t)}{\partial deficit_{t-k}} = \sum_{j=0}^{q} \alpha_j + \sum_{k=0}^{m} \vartheta_k TFP_{t-k} + \sum_{s=0}^{z} \vartheta_s wage\ share_{t-s} \quad (4)$$

Equation 4 indicates that the effect of fiscal deficit on unemployment varies at different levels of total factor productivity and wage share. The size and signs of ϑ_k and ϑ_s indicate how large the interaction influence modifies the effect of fiscal deficit on unemployment. Similar procedures to Equation (4) can be replicated with respect to TFP and the wage share, as well as with respect to lagged fiscal deficit and TFP.

The fiscal deficit and unemployment, and wage share data used in the study were obtained from the South African Reserve Bank and total factor productivity from the Federal Reserve Bank of St. Louis.

Results and Discussion

Unit Root Tests

Table 1. Unit root test results

	Levels	1st difference	2nd difference	Integration
ADF:				
Unemployment	-1.270	-3.835***		One
TFP	-0.520	-2.803*	-5.116***	Two
Deficit	-1.478	-4.451***		One
KPSS:				
Unemployment	0.399			Zero
TFP	0.498	0.259**		One
Deficit	0.156			Zero

Note: *** means p<0.01; ** means p<0.05 and *means p<0.10

The results of the unit root tests suggest that an ARDL model can be estimated since all variables are integrated of either order zero or one, except for TFP, which is integrated of order two at 1% (order one at 10%) under the ADF test. However, the KPSS test is a superior test to the ADF; thus, it is safe to rely on the KPSS for further analysis.

Regression Results and Interpretation

The F-bounds test in Table 2 shows that Equation (1) variables have a long-run relationship. The interpretation of the estimated results in Table 2 requires considerable care since the model has interactions of continuous variables. The coefficients in this case do not measure partial effects directly as demonstrated in Equation (4) (Kam & Franzese, 2007). To provide a more intuitive interpretation, the paper presents the graphs of the derivatives of unemployment with respect to current fiscal deficits, current TFP and current wage share evaluated with sample data. Graphs for lagged terms are not presented for the economy of space, but they yield similar intuition as the ones presented here. To give a dynamic view, the evaluated derivatives are plotted against time. This presentation enables a historical analysis of the resultant trends, which can be matched to some policy areas.

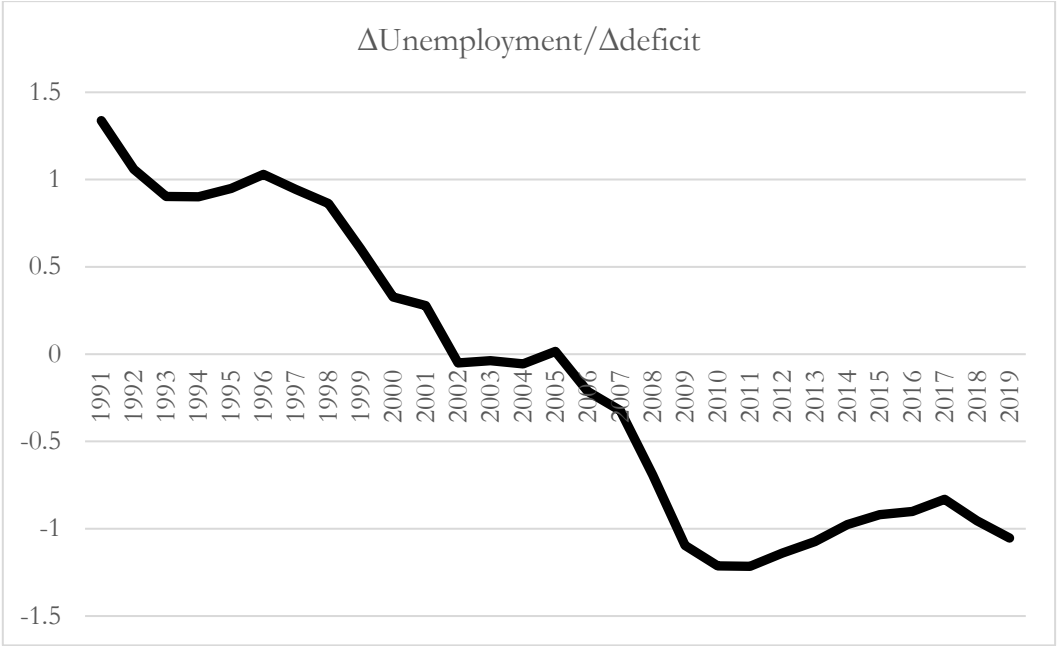
The trend in Figure 6 can be subdivided into four parts, namely, 1994-2002, 2002-2005, 2006-2011, and 2002-2019. The period 1994-2002 demonstrates that fiscal deficits, at various values of the wage share and TFP, increased unemployment at a diminishing rate. The period coincides with the golden years of fiscal consolidation, 1998-2008, the era of the Growth, Employment and Redistribution (GEAR) and part of the Accelerated Shared Growth Initiative South Africa (ASGISA) policies. In these periods, fiscal deficits were reduced significantly to the point of halving national debt between 1994 and 2008 (Burger & Calitz, 2021; Burger et al., 2016). Unfortunately, fiscal consolidation came at a price of rising unemployment just as heterodox

scholars maintain it should (Kelton, 2015, 2020; Marire, 2022b; Tanaka, 2022b, 2022a). The period 2002-2005 shows that fiscal deficits at various wage share and TFP levels had an almost zero effect on unemployment. This period coincides with the currency crisis of 2001/2002. The period 2006-2011 shows that fiscal deficits were associated with falling unemployment. This period coincides with the implementation of the Accelerated Shared Growth Initiative of South Africa (ASGISA), which replaced the neoliberal Growth, Employment and Redistribution (GEAR) policy of 1996-2004. The GEAR managed to deliver sound public finances but failed on some key social goals like reducing inequality, poverty and unemployment. Lastly, the period 2012-2019 indicated that fiscal deficits at various levels of the wage share and TFP reduced unemployment but at a diminishing rate.

Table 2 ARDL regression model

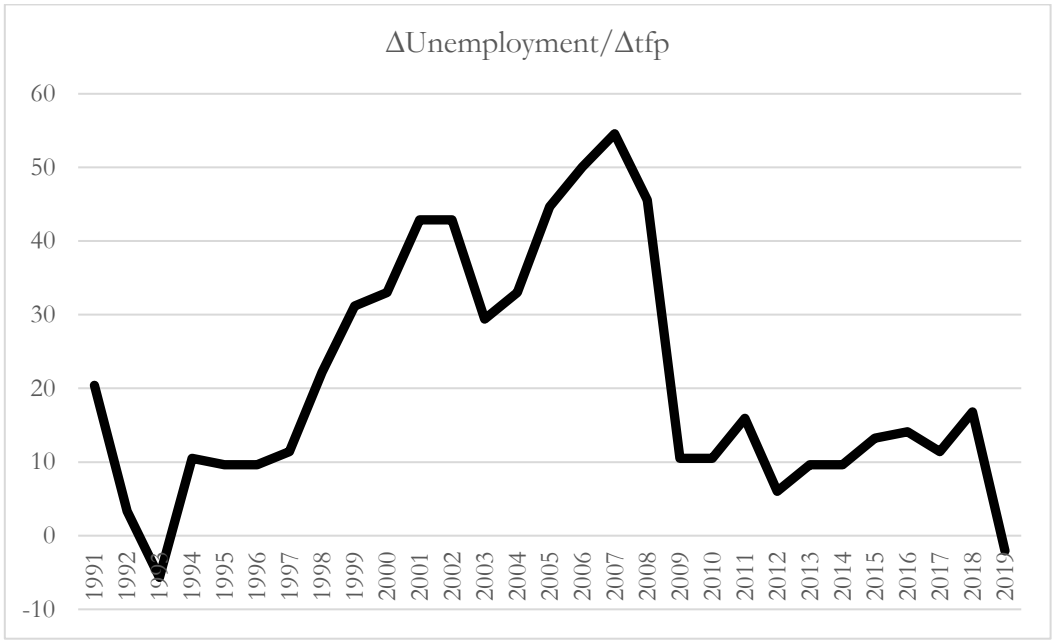
U_t (2, 1, 0, 0, 3, 3)	U_t	ECM model	ΔU_t
U_{t-1}	0.738***	ΔU_{t-1}	0.583***
	(0.161)		(0.112)
U_{t-2}	-0.583***	$\Delta Wageshare_t$	35.758
	(0.179)		(23.945)
$Wageshare_t$	35.758	ΔTFP_t	48.280***
	(77.451)		(10.884)
$Wageshare_{t-1}$	97.629*	ΔTFP_{t-1}	26.880**
	(49.331)		(10.311)
$Deficit_t$	-17.960***	ΔTFP_{t-2}	39.123***
	(4.652)		(9.049)
$Wageshare_t$ x $Deficit_t$	21.065***	Δ (TFP x Deficit)$_t$	8.995***
	(6.014)		(1.040)
TFP_t	48.280*	Δ (TFP x Deficit)$_{t-1}$	-0.829***
	(23.085)		(0.209)
TFP_{t-1}	24.404	Δ (TFP x Deficit)$_{t-2}$	-0.947***
	(21.718)		(0.199)
TFP_{t-2}	12.242	ECT_{t-1}	-0.845***
	(23.531)		(0.092)
TFP_{t-3}	-39.123**	Intercept	-79.802***
	(14.784)		(8.734)
TFP_t x $Deficit_t$	8.995***	R^2	0.861
	(2.854)		
TFP_{t-1} x $Deficit_{t-1}$	0.144	F	11.020
	(0.475)		[0.000]
TFP_{t-2} x $Deficit_{t-2}$	-0.118		
	(0.321)		
TFP_{t-3} x $Deficit_{t-3}$	0.947**		
	(0.339)		
Intercept	-79.802***		
	(24.628)		
R^2	0.969		
F, [prob]	24.545		
	[0.000]		
F-bounds, [5% crit. values]	9.563		
	[2.62; 3.79]		
Normality, χ^2, [prob]	0.424		
	[0.809]		
Serial correlation LM, χ^2, [prob]	4.018		
	[0.134]		
Het test, χ^2, [prob]	11.736		
	[0.626]		
Ramsey reset, t, [prob]	0.456		
	[0.658]		

Note: *** means p<0.01; ** means p<0.05 and *means p<0.10



Source: Author's analysis

Figure 6. Interaction effect of fiscal deficit & TFP on unemployment



Source: Author's analysis

Figure 7. Interaction effect of fiscal deficit and total factor productivity on unemployment

Similarly, Figure 7 can be partitioned into four parts, 1994-2002, 2003-2007, 2007-2009, and 2009-2018. An increase in TFP, at various values of fiscal deficit, worsened unemployment at an increasing rate during the first two periods. This is a puzzling finding, but the literature explains it. The literature identifies two potential explanations: that South Africa has experienced skill intensification (Banerjee et al., 2008; Jeremy Seekings & Nattrass, 2005) and capital intensification of production processes, with technology augmenting capital more than it does labour (Ferreira, 2016). In that sense, rising TFP could co-exist with unemployment. The advent of the global financial crisis, 2007-2009, might have changed the effect of TFP on unemployment at various levels of fiscal deficit. Marire (2022a) has shown that the productivity of the South African national innovation system changed after the global financial crisis. This shift might also have impacted the link between unemployment and TFP at various levels of fiscal deficit. The effect of TFP on unemployment at all levels of fiscal deficit remained largely stable between 2010 and 2019.

Source: Author's analysis

Figure 8. Interaction effect of wage share and fiscal deficit on unemployment

Between 1994 and 2000, the wage share, at all levels of fiscal deficit, increased the level of unemployment at an increasing rate (Figure 8), while between 2000 and 2008, the wage share, at all levels of fiscal deficit, increased unemployment at a diminishing rate. The plausible explanation is that the growth of government size, measured by rising budget deficits, might have resulted in a larger public service. The ruling political party instituted a cadre deployment policy, which increased the employment of many black African people in public service. The cadre deployment policy's goal was to ensure that the party captured the state for its development agenda by having a loyal bureaucracy. The large public service might have resulted in severe competition with the private sector for skilled labour resulting in rising wage costs. Rising wage costs would increase unemployment. Figures 7 and 8 looks identical, suggesting that the wage share and the TFP at all levels of fiscal deficit tend to have related but not similar effects.

The study's results demonstrate the value of controlling for interactions of fiscal and productivity variables in trying to explain unemployment and design inclusive economic policy interventions. The findings fit the empirical realities of South Africa. They suggest that the theoretical link between fiscal deficit and unemployment is not as straightforward as heterodox and neoclassical scholarship postulate but rather is non-linear and depends on the working out of the interactions between TFP and fiscal deficit on the one hand and fiscal deficit and the wage share on the other. The paper succeeds in demonstrating the value of controlling these interactions.

Causality Tests

Table 3. Block exogeneity causality tests

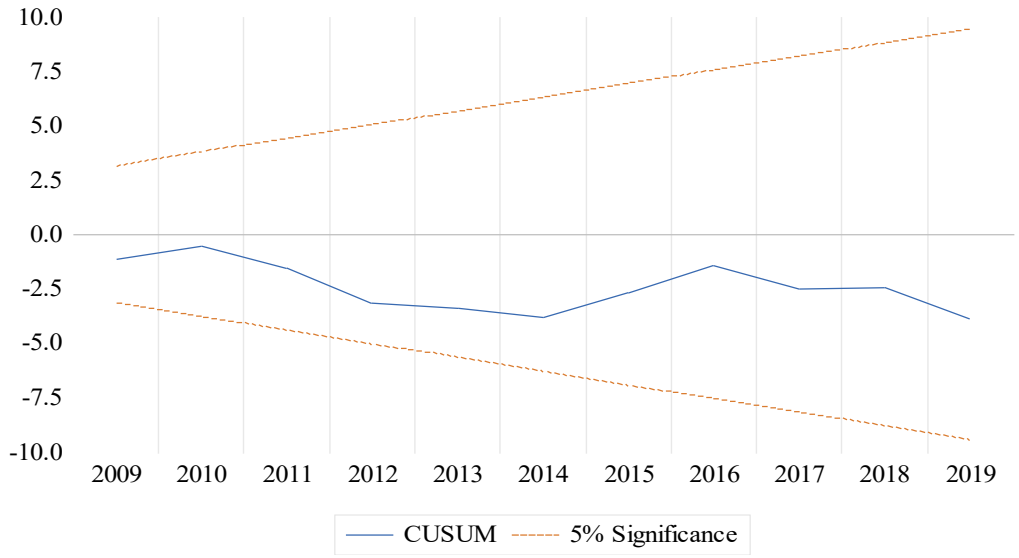
Excluded	F-stat [*t-stat]	P-value	Conclusion
Wage share	20.477	0.0002	Wage share granger causes unemployment
Deficit*	-3.861	0.0026	Deficit granger causes unemployment
Wage share x deficit*	3.502	0.0049	Interaction of wage share and deficit granger causes unemployment
TFP	7.662	0.0033	TFP granger causes unemployment
Deficit x TFP	4.929	0.0160	Interaction of TFP and deficit granger causes unemployment

Note: * means the test statistic is a t-statistic

Table 3 shows that unemployment, TFP, fiscal deficit and wage share, as well as their interactions granger-cause unemployment. The causality tests confirm theoretical postulations that fiscal deficits, wage shares and TFP influence unemployment.

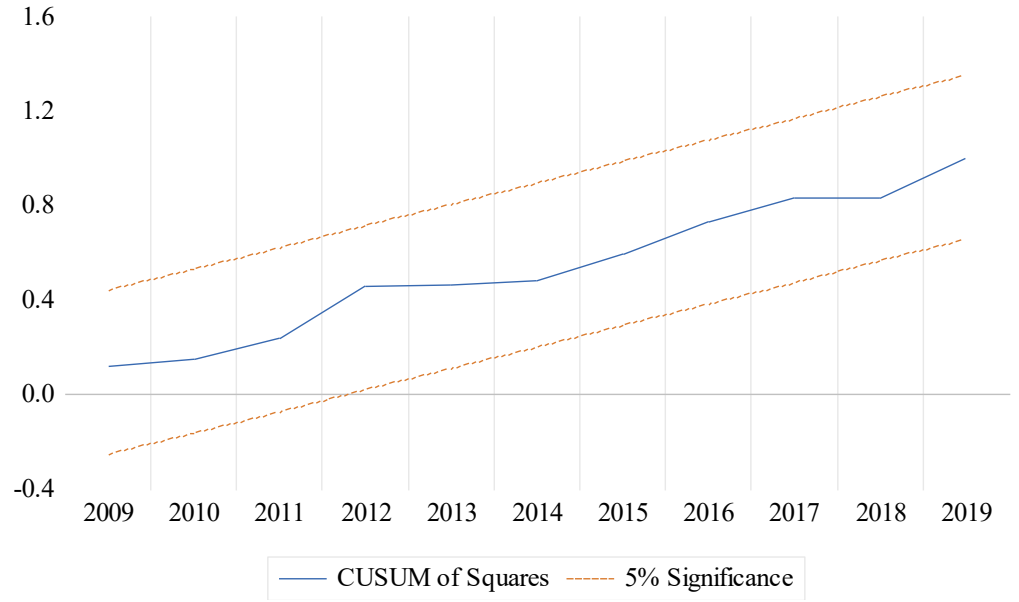
Stability Tests

The diagnostic tests in Table 2 suggest that the model does not suffer from classical regression problems such as heteroscedasticity, serial correlation, non-normality, as well as specification bias, judging by the Breusch-Pagan-Godfrey, Breusch-Godfrey, Jarque-Bera and Ramsey Reset tests respectively. Further, the CUSUM and CUSUM squared, Figures 8 and 9, indicate that the model's parameters satisfy the stability condition.



Source: Author's analysis

Figure 9. CUSUM test



Source: Author's analysis

Figure 10. CUSUM of squares test

Conclusion

The paper investigated the effect on unemployment of the interaction of fiscal deficits and total factor productivity on the one hand and fiscal deficits and the wage share on the other. The effect of the interactions has remained an unexamined issue in the context of South Africa and, more broadly, in literature. Three broad conclusions were derived from the findings. First, fiscal consolidation increases unemployment, and this is more so in the context of the interaction of fiscal deficit and total factor productivity, as well as with wage share. However, an expansionary

fiscal policy reduces unemployment, especially with rising productivity and wage share. Second, increases in total factor productivity increase unemployment at different levels of fiscal deficit. This means that the interaction of rising productivity and fiscal deficits, in the South African context, where the growth regime is profit-led always results in increasing unemployment. In this case, even technological dividends improve the earning capacity and employability of capital, not labour. Third, as the wage share increases, unemployment increases, and the effect is much more pronounced when wage share and fiscal deficit interact.

The study has both theoretical and policy implications. First, theories that explain unemployment must control for interactions of various factors that define the structure of factor markets, good markets and economic policy. Interactions help us move away from linear models that often give a partial understanding of the examined problems. For example, the demand deficiency theory of unemployment benefits from interacting fiscal parameters and variables with labour market parameters to clearly understand how a fiscal strategy will work out and whether it will achieve the intended goals. Another example is structural theories of unemployment and hysteresis of unemployment benefit from interactions.

The policy implication of the study is that South Africa needs to rethink its commitment to structural fiscal policy. For a long time, nearly 20 years, she has been pursuing fiscal consolidation while lamenting the stubbornness of unemployment. Sound finances that do not lead to an economy that works for all are not something to be particularly proud of. The policymakers need to find a middle-of-the-road approach that accommodates the policy wisdom from heterodox scholarship and the more conventional neoclassical wisdom. Since falling fiscal deficits controlling for the level of productivity and the wage share agrees with long-held claims that South Africa suffers from a structural demand deficiency driven by a low wage regime. A return to the virtuous Keynesian growth model that is wage driven seems to cure the present weak aggregate demand problem.

The findings bring a new understanding that expansionary fiscal policy does not necessarily create an economy that works for all unless active labour market institutions are set up in ways that transform the economy into an inclusive one. For example, the institution of job guarantees would result in TFP and fiscal deficits interacting in a way that reduces unemployment. Current public works programmes that provide transitory jobs provide a less effective solution to unemployment. Further, investing in innovation and productivity in an economy that is profit-led always results in jobless growth. Alternatively, even worse, destruction of existing jobs.

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Economic Journal of Emerging Markets
Available at https://journal.uii.ac.id/jep

Structural breaks, financial globalization, and financial development: Evidence from Turkey

Pinar Avci[1*], Murat Cetin[2]

[1]School of Sarköy Vocational, Tekirdag Namik Kemal University, Tekirdag, Turkey
[2]Faculty of Economics and Administrative Sciences, Tekirdag Namik Kemal University, Tekirdag, Turkey
[*]Corresponding author: pavci@nku.edu.tr

Article Info

Article history:
Received 14 January 2022
Accepted 23 September 2022
Published 5 October 2022

JEL Classification Code:
F60, E44, O16

Author's email:
mcetin@nku.edu.tr

DOI: 10.20885/ejem.vol14.iss2.art5

Abstract

Purpose — Mishkin's hypothesis suggests that globalization appears to be a vital factor in stimulating the development of the financial system. The study examines this hypothesis for the Turkish economy from 1970 to 2017. It focuses on the link between financial globalization and financial development by integrating economic growth, inflation, and natural resource rent as additional determinants into the financial development specification.

Methods — The Ng-Perron and Vogelsang-Perron unit root tests are used to check the stationarity of variables. The cointegration analysis is performed using the Hatemi-J and ARDL bounds testing procedures.

Findings — The main empirical results show that the series are cointegrated under structural breaks; in the long run, financial globalization and economic growth increase financial development while inflation and natural resource rent negatively affect financial development. A unidirectional causality exists from financial globalization and economic growth to financial development. At the same time, there is bidirectional causality between inflation and financial development, natural resource rent, and financial development.

Implications — The empirical findings can present important recommendations for policymakers.

Originality — Very few time-series studies include Turkey's economy and structural breaks.

Keywords — Financial globalization, financial development, economic growth.

Introduction

In 1973, after Bretton Woods, many dimensions of globalization, such as economic, trade, financial, social, political, and environmental, and their effects on various development areas had become the topics to be studied and discussed (Balcilar, Gungor, & Olasehinde-Williams, 2019). For example, globalization can affect economic growth (Ghosh, 2017), income inequality (Adams, 2008), energy consumption (Chen & Chen, 2011), employment (Chen, Felipe, Kam, & Mehta, 2021), trade (Egger & Fischer, 2020), and human capital (Li, Lu, Song, & Xie, 2019). Although these studies intensify the relationship between globalization and several macroeconomic variables, they do not consider the globalization-financial development link.

Many researchers suggest that globalization affects financial development in both emerging and developed economies (García, 2012; Haseeb, Xia, Danish, Baloch, & Abbas, 2018; Mishkin,

P ISSN 2086-3128 | E ISSN 2502-180X

2009). Globalization contributes to financial market development by increasing domestic savings, reducing costs with global risk distribution, using new technologies, and promoting managerial knowledge transfusion (Häusler, 2002). Moreover, globalization causes sudden inflows and outflows of international capital in developing countries. Therefore, economic and financial crises have risen in these countries (Harris, 1999). Hence, the disappearance of borders in the financial market is becoming a single world market; in other words, financial globalization creates advantages and disadvantages (Avcı, 2020).

Mishkin's study (2009) is one of the pioneer studies to theoretically argue that globalization may encourage economic growth by considering multi-directional links between globalization, financial development, and institutional capacity. He focuses on the connection between globalization and the financial sector. According to Mishkin (2009), globalization helps to develop financial institutions by leading domestic financial institutions to enter foreign markets. It may decrease bureaucracy and enhance a country's property rights and political stability. It enables domestic and foreign investors to access capital from banking and stock markets by improving institutional capacity. Consequently globalization has a beneficial impact on the financial sector. García (2012), Haseeb et al. (2018), Rajan and Zingales (2003) agree with the idea of Mishkin (2009). Rajan and Zingales (2003) conclude that globalization benefits the development of the financial sector. Garcia (2012) indicates that financial globalization decreases international transaction costs and strengthens the international link between the financial and real sectors. Finally, Haseeb et al. (2018) summarize that globalization is accepted as a crucial determinant of economic growth and financial development by triggering institutional reforms. Finally, it can be said that globalization has positive effects on economic and financial development.

Tornell, Westermann, and Martínez (2004) suggest that financial liberalization has generally followed trade liberalization in developing countries. For several reasons, the Turkish economy is selected as a case for our empirical study. First, Turkey, an emerging economy, has gradually started liberalization since the 1980s. Turkey's liberalization process has initiated with the 24th January 1980 decisions. The foreign trade regime was revised in 1980. Since then, tariffs have been reduced, and all governments have started adopting export-oriented policies (Çevik, Atukeren, & Korkmaz, 2019). Moreover, The Investment Support and Promotion Agency of Turkey (ISPAT) was launched in 2006 to attract foreign investors.

Second, The Turkish Investment Report (2020) presented by the U.S. Department of State indicates that Turkey has one of the most liberal legislative reforms for FDI among OECD countries. One of its essential development targets is to fascinate new foreign direct investments (FDI) significantly. In this respect, Turkey's investment incentive schemes were revised to stimulate investment in related sectors in 2018. Turkey attracted a total of USD 5.6 billion in FDI in 2019.

Based on the considerations above, the present study focuses on the relationship between financial globalization and financial development for the Turkish economy. It can be seen in Table 1 that there are very few time-series studies that include Turkey's economy and structural breaks. Here, we investigate Mishkin's argument that globalization is a crucial factor that encourages financial development and economic growth in developing economies. For this purpose, the study integrates economic growth, inflation, and natural resource rent into the financial development equation as additional variables. We first use the Ng-Perron and Vogelsang-Perron tests to check the stationarity of variables. Secondly, we use the ARDL bounds test and Hatemi-J cointegration procedure to identify the long-run relationship between the variables. Thirdly, we estimate the long-term coefficients applying the Fully Modified Ordinary Least Squares (FMOLS) and Canonical Cointegrating Regressions (CCR) estimators. Finally, the causality analysis is conducted through the Vector Error Correction Model (VECM) Granger causality test.

It is stated that globalization is an essential factor that stimulates financial development, especially for developing countries (Mishkin, 2009). Several empirical studies dwell on various time-series analyses for different countries (Atil, Nawaz, Lahiani, & Roubaud, 2020; Guan, Kirikkaleli, Bibi, & Zhang, 2020; Shahbaz, Mallick, Mahalik, & Hammoudeh, 2018). First, Shahbaz et al. (2018) dwell on the globalization-financial development link for India over the period 1971-2013. Using the ARDL procedure, the study reveals that social, economic, and political globalization and

inflation are negatively related to financial development in the long run. In contrast, economic growth and population are positively linked with financial development. The study also reveals that social, economic, and political globalization causes financial development in the long run. Second, Guan et al. (2020) explore the nexus between natural resources and financial development by considering the impact of globalization on China between 1971-2017. They include human capital and economic growth in the financial development model. The findings show that the series are cointegrated. There exists a long-run relationship among the variables. The results of ARDL, FMOLS, DOLS, and CCR suggest that globalization is positively linked with financial development in the long run. The results also show that globalization causes financial development in the short and medium-run. Last, Atil et al. (2020) investigated the link between natural resources and financial development in Pakistan between 1972-2017. The long-run covariability analysis findings suggest that economic globalization reduces financial development. This finding supports the results of Shahbaz et al. (2018), but it does not confirm the results of Guan et al. (2020).

There exist many studies which examine the nexus between globalization and financial development by using the panel data methods. García (2012) indicates that financial globalization, trade openness, and economic growth have a positive effect on credit and stock market values which are indicators of financial development. However, inflation has a detrimental influence on financial development. Asongu (2014) explores 15 African countries from 1996-2009 and globalization hampers financial development.

Law, Tan, and Azman-Saini (2015) intensify the links between globalization, institutions, and financial development in East Asia from 1988-2008. The study uses private sector credit and stock market capitalization as indicators of financial development. The results indicate a positive relationship between globalization and financial development. Private sector credit causes globalization, while globalization causes stock market capitalization in the long run.

Helhel (2017) tests the link between globalization and financial development for BRICS countries and Turkey from 2002-2015. She suggests that globalization positively affects financial development in the long run. This finding is in line with the results of Muye and Muye (2017), who examined the link between globalization, institutions, and financial development for BRICS, MINT, and ECOWAS countries from 1984 to 2013; Haseeb et al. (2018), who investigated the relationship among financial development, globalization, and carbon emissions for BRICS countries from the period of 1995-2014; Zaidi et al. (2019), who examine the links among globalization, economic growth, natural resources, human capital, gross fixed capital formation and financial development for 31 OECD countries during the period 1990-2016. Moreover, Balcilar et al. (2019) find that globalization, economic growth, trade openness, and institutional quality have a significant and positive impact on financial development for 36 countries over the period 1996-2016. Contrary to these studies, Asongu (2017) and Nasreen, Mahalik, Shahbaz, and Abbas (2020) show that globalization injures financial development.

Several studies exist intensifying the causal linkage between globalization and financial development by applying the Dumitrescu-Hurlin causality approach. Zaidi, Zafar, Shahbaz, and Hou (2019) investigated APEC countries from 1990-2016, while Saud, Chen, Haseeb, and Sumayya (2020) examined 49 countries between 1990-2004. The first study shows a unidirectional causality running from globalization to financial development, while the second study indicates a bidirectional causality between the variables.

Methods

This study deals with the link between financial globalization and financial development using the time-series methodology for the Turkish economy. The motivation to create this econometric model is based on Mishkin's hypothesis, which is *globalization encourages the development of the financial system*. Moreover, Law et al. (2015) and Nasreen et al. (2020) put emphasis on globalization, institutional nature, inflation rate, and economic growth. Shahbaz et al. (2018) examine the impact of various globalization indicators on financial development. Shahbaz, Naeem, Ahad, and Tahir (2018) discuss the role of natural resources, economic growth, education, and capitalization in financial development, which have a debilitating or adverse effect on sectors. In the study, it is

determined that a financial system improves economic growth compensating for the negative impact of natural resources on economic growth. Zaidi, et al. (2019) find it plays a key role in increasing financial development using globalization and natural resources effectively. Therefore, as seen in these empirical studies, important variables such as globalization, economic growth, natural resources, and inflation rate, which are the determinants of financial sector development, are analyzed for different countries. Still, it has been determined that this issue has not been examined for the Turkish economy. Finally, the econometric model of our study is determined as follows, taking into account the empirical models in studies such as Guan et al. (2020) and Atil et al. (2020):

$$lnFD_t = \delta_0 + \delta_1 lnFGL_t + \delta_2 lnGDP_t + \delta_3 lnINF_t + \delta_4 lnNRR_t + \mu_t \quad (1)$$

Where FD is liquid liabilities (% of GDP) as a measure of financial development (Asongu, 2017; Nasreen et al., 2020), FG is the financial globalization index as an indicator of globalization (Nasreen et al., 2020), GDP is per capita real income (constant 2010 US$), which indicates a measure of economic growth (Guan et al., 2020), INF is consumer price index (annual %) as a measure of inflation (Bittencourt, 2011); and NRR is natural resource rent (the total rents of natural resources, %of GDP) (Shahbaz, Naeem, et al., 2018).

t is the time term 1970-2017, and the residual term, which is normally distributed and it is indicated by μ. δ_0 is the intercept, δ_1,δ_2,δ_3, and δ_4 are the long-run coefficients for liquid liabilities with financial globalization, per capita real income, consumer price index and natural resource rent, respectively. We employ the logarithmic values of the variables to obtain the elasticity coefficients.

The time-series data from 1970 to 2017 are used in this study. The period starts with the year 1970 due to the availability of data set for the financial globalization index. The data on liquid liabilities, per capita real income, consumer price index, and natural resource rent are gathered from the World Bank, World Development Indicators-WDI (2020) database. The financial globalization index is obtained from KOF Swiss Economic Institute (2019) database. Table 1 indicates the variables and their expected signs. The statistics and correlations are indicated in Table 2. Fig.1. demonstrates the trends of the variables during the period 1970-2017.

Table 1. Variables and their expected signs.

Variables	Definition	Source	Expected sign
FD_t	Liquid liabilities (% of GDP)	WDI	-
FGL_t	Financial globalization index	KOF	(+)(-) Asongu (2014); Guan et al. (2020)
GDP_t	Real GDP per capita (constant 2010US$)	WDI	(+) Atil e al. (2020)
INF_t	Consumer price index (annual, %)	WDI	(-) Asongu (2017)
NRR_t	The total rents of natural resources (%of GDP)	WDI	(-)(+) Shahbaz et al. (2018b); Guan et al. (2020)

Table 2. Descriptive statistics and correlations.

Statistics/Variables	FD_t	FGL_t	GDP_t	INF_t	NRR_t
Mean	3.273	3.729	8.902	3.276	-0.697
Median	3.111	3.873	8.871	3.409	-0.617
Std.dev.	0.324	0.284	0.352	0.922	0.565
Min.	3.797	4.055	9.607	4.656	0.308
Max.	2.713	3.246	8.348	1.833	-2.095
Skewness	0.379	-0.617	0.345	-0.158	-0.249
Kurtosis	1.803	1.829	2.061	1.505	2.493
Obs.	48	48	48	48	48
LFD_t	1.000				
LFG_t	0.694	1.000			
$LGDP_t$	0.900	0.823	1.000		
$LINF_t$	-0.687	-0.073	-0.480	1.000	
$LNRR_t$	-0.479	-0.636	-0.565	-0.023	1.000

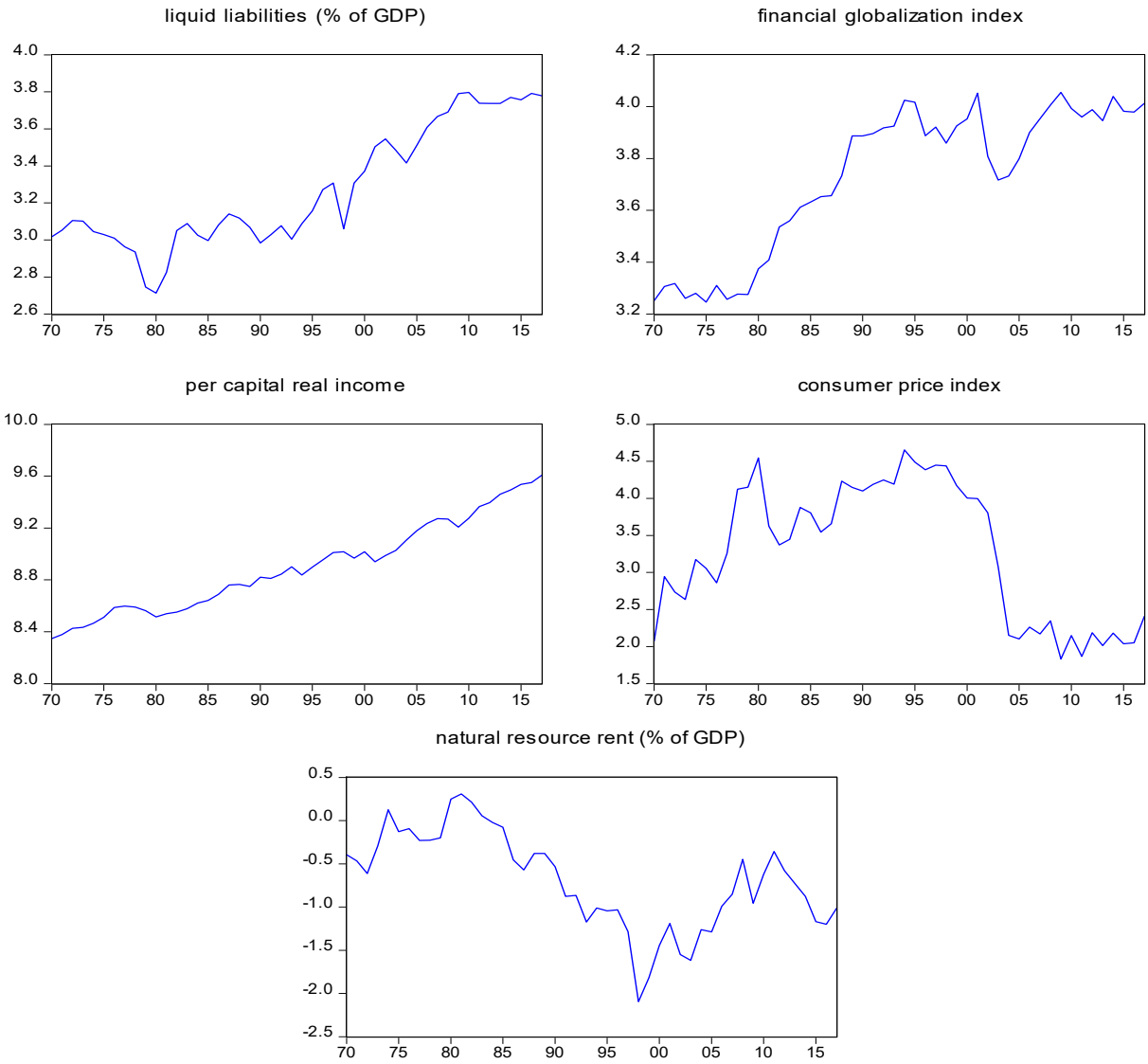

Figure 1. Trends of the variables (1970-2017).

The times series technique is utilized to test the model (1). Firstly, the stationary analysis of variables is conducted via the Ng-Perron unit root and Vogelsang-Perron (AO and IO models) tests with one structural break. The property of the Ng-Perron tests is used to eliminate the restrictions of ADF and PP tests. Ng and Perron (2001) suggest four test statistics for stationarity analysis: MZ_a, MZ_t, MSB, and MPT. These tests can be formulated as follows:

$$MZ_\alpha = \left(\left(T^1 y_T^d\right)^2 - f_0\right)/2k \quad (2)$$

$$MZ_t = MZ_\alpha x\, MSB \quad (3)$$

$$MSB = (k/f_0)^{1/2} \quad (4)$$

$$MPT = (\bar{c}^2 k - \bar{c}\, T^1)(y^d T)^2/f_0 \quad (5)$$

The findings can be biased and spurious because Ng-Perron unit root tests do not consider structural breaks in the series (Alkhathlan & Javid, 2013). We also use the Vogelsang-Perron unit root test, which considers one structural break. This procedure developed by Bai and Perron (1998) can be applied with the help of two different models (the additive outlier value (AO) model and the innovation outlier value (IO) model). We employ the AO model to investigate the stationarity properties of the variables in this study.

In the second stage, the ARDL bounds test and Hatemi-J cointegration approach are applied to determine the presence of cointegration between the variables. The traditional cointegration tests developed by Engle and Granger (1987) and Stock and Watson (1999) require

that the series are integrated at *I*(1). The ARDL approach provides statistically more reliable results than the classical cointegration test results since the unrestricted error correction model (UECM) is used. Additionally, the long-run and short-run parameters can be estimated through the UECM (Pesaran et al., 2001). The UECM can be shown as follows:

$$\Delta InFD_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i}\, \Delta InFD_{t-i} + \sum_{i=0}^{q} \alpha_{2i}\, \Delta lnFGL_{t-i} + \sum_{i=0}^{q} \alpha_{3i}\, \Delta lnGDP_{t-i} + \sum_{i=0}^{q} \alpha_{4i}\, \Delta lnINF_{t-i} + \sum_{i=0}^{q} \alpha_{5i}\, \Delta lnNRR_{t-i} + \beta_1 InFD_{t-1} + \beta_2 lnFGL_{t-1} + \beta_3 lnGDP_{t-1} + \beta_4 lnINF_{t-1} + \beta_5 lnNRR_{t-1} + \beta_6 D_{1999} + u_t \quad (6)$$

In the ARDL approach, Akaike information criteria (AIC) or Schwarz information criteria (SIC) are used to assign the suitable lag length. Following Alkhathlan and Javid (2013), we employ the SIC for the optimal lag length (Pesaran, Shin, & Smith, 2001).

Lower and upper critical bounds derived by Narayan (2005) and Pesaran et al. (2001) are compared with the *F*-statistic to obtain information regarding the cointegration between the variables. If the computed *F*-statistic is between these critical bounds, we do not provide any information about cointegration. Moreover, we implement various diagnostic tests such as normality, serial correlation, heteroskedasticity, and, functional form to investigate the reliability of the ARDL approach.

The two structural breaks test suggested by Hatemi-J (2008) are also used to investigate the cointegration among the series in this study. This test is an augmented form of Gregory and Hansen (1996) test with one structural break. Moreover, Hatemi-J (2008) test benefits from the ADF test offered by Engle and Granger (1987) and Z_a and Z_t test statistics developed by Phillips (1987) to analyze whether or not there exists a cointegration between the variables in the model. We apply the model with two structural breaks, both in constant and slope suggested by Hatemi-J (2008). This model can be expressed as follows:

$$y_t = \alpha_0 + \alpha_1 D_{1t} + \alpha_2 D_{2t} + \beta_0' x_t + \beta_1' D_{1t} x_t + \beta_2' D_{2t} x_t + \mu_t \quad (7)$$

where D_{1t} and D_{2t} represent the dummy variables expressing two structural breaks. These dummy variables can be shown as follows:

$$D_{1t} = \begin{cases} 0 \; if \; t \leq [n\tau_1] \\ 1 \; if \; t > [n\tau_1] \end{cases} \text{ and } D_{2t} = \begin{cases} 0 \; if \; t \leq [n\tau_2] \\ 1 \; if \; t > [n\tau_2] \end{cases} \quad (8)$$

Here, $\tau_1 \in (0, 1)$ and $\tau_2 \in (0, 1)$ represent unknown parameters denoting the timing of the respective structural break point. The test statistics can be stated as follows:

$$ADF^* = \inf_{(\tau_1, \tau_2)\epsilon T} ADF(\tau_1, \tau_2) \quad (9)$$

$$Z_t^* = \inf_{(\tau_1, \tau_2)\epsilon T} Z_t(\tau_1, \tau_2) \quad (10)$$

$$Z_\alpha^* = \inf_{(\tau_1, \tau_2)\epsilon T} Z_\alpha(\tau_1, \tau_2) \quad (11)$$

The ADF, Z_a, and Z_t test statistics which have a non-standard distribution, are compared with the critical values tabulated by Hatemi-J (2008) to decide whether the null hypothesis of no cointegration is rejected or not. In the third stage, the long-term coefficients are estimated by the FMOLS and CCR estimators. The CCR and FMOLS procedures necessitate that the series are integrated at *I*(1). These approaches are carried out by employing Bartlett Kernel with Newey-West fixed bandwidth (Abu & Staniewski, 2019).

Finally, the VECM Granger causality analysis is performed to investigate causality between the variables. The VECM procedure includes the error-correction term (ECT_{t-1}) obtained from the long-run model in the classical VAR model as a new variable. The VECM can be specified as follows:

$$(1-L)\begin{bmatrix} lnFD_t \\ lnFGL_t \\ lnGDP_t \\ lnINF_t \\ lnNRR_t \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \end{bmatrix} + \sum_{i=1}^{p}(1-L)\begin{bmatrix} c_{11i}c_{12i}c_{13i}c_{14i} \\ c_{21i}c_{22i}c_{23i}c_{24i} \\ c_{31i}c_{32i}c_{33i}c_{34i} \\ c_{41i}c_{42i}c_{43i}c_{44i} \end{bmatrix} x \begin{bmatrix} lnFD_{t-1} \\ lnFGL_{t-1} \\ lnGDP_{t-1} \\ lnINF_{t-1} \\ lnNRR_{t-1} \end{bmatrix} + \begin{bmatrix} \beta \\ \theta \\ \delta \\ \gamma \end{bmatrix} ECT_{t-1} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \\ u_{4t} \end{bmatrix} \quad (12)$$

When the coefficient of ECT_{-1} is negative and statistically significant, it shows a long-term causal relationship among the variables.

Results and Discussion

Table 3 reports the results of Ng-Perron unit root tests. The results show that the variables include unit roots, which implies that they are not stationary at their level. The variables can be said to be stationary in their first difference. The results are in line with the findings of the Vogelsang-Perron AO model (Table 4). Therefore, we conclude that they are integrated at *I*(1). Table 4 also indicates the structural break dates for financial development, financial globalization, economic growth, inflation, and natural resource rent are 1999, 1981, 2002, 2002, and 1985, respectively.

Table 3. Ng-Perron unit root test.

Regressor	MZ_a	MZ_t	*MSB*	*MPT*	Results
Panel A: Level					
FD_t	-0.125	-0.066	0.532	20.275	-
FGL_t	-0.059	-0.041	0.687	29.635	-
GDP_t	2.458	3.001***	1.220	130.126	-
INF_t	-2.577	-1.127	0.437	9.469	-
NRR_t	-4.479	-1.452	0.324	5.549	-
Panel B: First difference					
ΔFD_t	-158.454***	-8.898***	0.056***	0.158***	*I*(1)
ΔFGL_t	-22.809***	-3.377***	0.148***	1.074***	*I*(1)
ΔGDP_t	-22.988***	-3.375***	0.146***	1.117***	*I*(1)
ΔINF_t	-15.344***	-2.769***	0.180**	1.597***	*I*(1)
ΔNRR_t	-22.985***	-3.366***	0.146***	1.144***	*I*(1)

Note: The optimal lag length is selected by SIC.***, ** and * show the significant at 1%, 5% and 10% level of significance, respectively.

Table 4. Vogelsang-Perron test.

Models	Additive outlier		
Variables	*t*-statistic	Time break	Results
Panel A: Level			
FD_t	-3.525(0)	1999	-
FGL_t	-3.192(0)	1981	-
GDP_t	-1.527(0)	2002	-
INF_t	-4.516(0)	2002	-
NRR_t	-3.049(0)	1985	-
Panel B: First difference			
ΔFD_t	-7.334(0)***	1982	*I*(1)
ΔFGL_t	-7.205(0)***	1989	*I*(1)
ΔGDP_t	-7.133(0)***	2001	*I*(1)
ΔINF_t	-7.877(0)***	2004	*I*(1)
ΔNRR_t	-7.953(0)***	1998	*I*(1)

Note: *** shows significance at 1%.

The year 1999 is very important for the Turkish economy. The Asian (1997) and Russian (1998) crises led to a long-time crisis in 1998 and 1999 in Turkey. In these years, the Turkish economy witnessed high inflation and negative growth. For these reasons, the Turkish government signed the 17th stand-by agreement with the IMF in 1999. There was also the Marmara earthquake in 1999 (Uygur, 2010).

Before applying the cointegration tests, the optimal lag length should be detected. The optimal lag length is determined using the SIC through the VAR model. When looking at Table 5, the optimal lag length is found as 1.

Table 5. Selection of appropriate lag length.

Lag length	*LR*	*FPE*	*AIC*	*SIC*	*HQ*
1	361.757	2.76e-10*	-7.831	-6.614*	-7.379*
2	28.317	3.81e-10	-7.552	-5.322	-6.725
3	40.393*	3.16e-10	-7.859	-4.615	-6.656
4	31.622	3.19e-10	-8.097*	-3.839	-6.518

Note: * shows optimal lag length.

We apply the cointegration techniques developed by Pesaran et al. (2001) and Hatemi-J (2008) to analyze the long-term relationship between financial development and independent variables under structural breaks. The findings in Table 6 show that the computed *F*-statistic is 7.67 and statistically significant at a 1% level of significance. The findings also show that the coefficient of $ECT_{(t-1)}$ is -0.450. In addition, the values of ADF^* and Z_t^* obtained from the Hatemi-J cointegration analysis are 7.998 and -8.085, respectively. These values are statistically significant at a 5% level of significance. So, the results mean that there exists a long-run link between financial globalization, economic growth, inflation, and natural resource rant and financial development over the period. Our results are confirmed by Atil et al. (2020) for Pakistan, Guan (2020) for China, Balcılar et al. (2019 for 36 countries, Zaidi, Wei, et al. (2019) for 31 OECD countries, Haseeb et al. (2018) for BRICS countries and Helhel (2017) for BRICS countries and Turkey.

Table 6. Cointegration tests.

Panel A: Bounds *F*-test		
Estimated equation	*F(FD/FGL,GDP,INF,NRR)*	
Optimal lag structure	[1,0,0,0,0]	
F-statistic	7.67***	
Structural breaks	1999	
$ECT_{(t-1)}$	-0.450***	
Pesaran et al. (2001) critical values		
Significance level	Lower bounds, *I*(0)	Upper bounds, *I*(1)
1%	4.40	5.72
5%	3.47	4.57
10%	3.03	4.06
Narayan (2005) critical values		
Significance level	Lower bounds, *I*(0)	Upper bounds, *I*(1)
1%	5.18	6.68
5%	3.83	5.06
10%	3.24	4.35
Panel B: Hatemi-J test		
Test statistics	Estimated value	
ADF^*	7.998**	
Z_t^*	-8.085**	
Z_α^*	-54.490	
Break dates	1989;1996	
Cointegration	Yes	

Note: The optimal lag length is selected based on SIC. ***and ** denote significance at 1% and 5%, respectively.

Table7 presents the results obtained from the FMOLS and CCR estimates. The findings demonstrate the long-term impact of financial globalization, economic growth, inflation, and natural resource rent on financial development. In Table 7, it is seen that the estimation methods give similar results. According to the FMOLS results, the coefficient of financial globalization is 0.325 and statistically significant at a 5% level. This reveals that financial globalization is positively linked with financial development. This means that a 1% rise in financial globalization increases financial development by 0.325%. This finding validates Mishkin's claim (2009) that globalization is a powerful driver of financial development. Our result is supported by Guan et al. (2020) for China, Helhel (2017) for BRICS countries, and Turkey and Garcia (2012) for 26 transition countries. However, our result is not proved by Atil et al. (2020) for Pakistan and Asongu (2014; 2017) for African countries.

The results reveal that the estimated coefficient of economic growth is 0.285 and statistically significant at a 5% level. This shows that economic growth positively affects financial development. This implies that a 1% increase in economic growth rises financial development by 0.285%. This result confirms Patrick's demand following hypothesis (1966). Our finding is consistent with Guan et al. (2020) for China and Balcılar et al. (2019) for 36 countries.

We find that the inflation coefficient remains negative and statistically significant at the 1% level. This states that inflation negatively affects financial development. This implies that a 1% rise in inflation decreases financial development by 0.186%. Our finding is in line with Shahbaz, Mallick, et al (2018) for India, Nasreen et al. (2020) for European countries, and Bittencourt (2010) for Brazil.

We also find that natural resource rent has a negative and statistically significant coefficient. This reveals that financial development is negatively influenced by natural resource rent, which means that a 1% increase in natural resource rent reduces financial development by 0.182%. This result is supported by Guan et al. (2020) for China. Our result is not in line with Atil et al. (2020) for Pakistan and Shahbaz, Naeem, et al. (2018) for the USA.

Table 7. FMOLS and CCR estimates.

Methods	FMOLS		CCR	
Variables	Coefficients	*t*-statistics	Coefficients	*t*-statistics
Constant	0.084	0.103	-0.074	-0.094
FGL_t	0.325**	2.692	0.317**	2.526
GDP_t	0.285**	2.368	0.305**	2.506
INF_t	-0.186***	-6.943	-0.182***	-7.067
NRR_t	-0.073**	-2.086	-0.070*	-2.007
Diagnostictests				
R^2	0.919		0.919	
Adj. R^2	0.911		0.911	
SE of regression	0.096		0.096	
SSR	0.393		0.391	

Note: The optimal lag length is selected based on SIC. ***, ** and* show significance at 1%, 5% and 10%, respectively.

The causality results obtained from the VECM approach are reported in Table 8. The findings show that financial globalization causes financial development in the long run. This result confirms the finding of Zaidi, Zafar, et al. (2019), who examine the causality link between globalization and financial development in APEC countries from 1990-2016. The study shows that globalization causes financial development. This result coincides with the results of Ahmed, Zhang, and Cary (2021) for Japan. On the contrary, this finding does not coincide with the results of Sethi, Chakrabarti, and Bhattacharjee (2020).

The findings also show that there exists a unidirectional causality from economic growth to financial development in the long run. This finding is similar to the results of Ahmed et al. (2021) for Japan. Our finding is not similar to the results of Song, Chang, and Gong (2021).

It is found that inflation and financial development cause one another in the long run. Our finding confirms the results of Satti, Shahbaz, Mujahid, and Ali (2013), who investigate the effect of financial development on inflation in Bangladesh from 1976Q1-2012Q4. This study presents that there exists bidirectional causality between the variables. Our finding coincides with the results of Yang (2019) for middle-income countries and Satti et al. (2013)cfor Bangladesh. On the contrary, Sanusi et al. (2017) show that inflation causes financial development in South Africa over the period 2007-2016.

It is also found that there exists a long-run bidirectional causal linkage between natural resource rent and financial development. This finding coincides with the result of Phuc Canh & Trung Thong (2020), who deal with the relationship between financial development and natural resource rent for 86 countries over the period of 2002-2017. The study shows that there exists bidirectional causality between the variables. Our result supports the findings of Faisal, Sulaiman, and Tursoy (2019) for Turkey. But our result is not consistent with the findings of Quixina and Almeida (2014). They obtain the unidirectional causality from oil rent to financial development in the Angolan economy for the period of 1995-2012.

Table 8. Causality results.

Dependent variables	Independent variables					
	Short-run *F*-statistic(p-value)					Long-run (p-value)
	ΔFD	ΔFGL	ΔGDP	ΔINF	ΔNRR	ECT_{t-1}
ΔFD	-	-1.376	-1.585	-0.942	1.272	-0.636***
		(0.176)	(0.120)	(0.351)	(0.210)	(0.000)
ΔFGL	-1.534	-	1.346	-0.815	0.477	-0.076
	(0.133)		(0.185)	(0.419)	(0.635)	(0.517)
ΔGDP	1.277	-0.400	-	-0.698	-0.042	-0.088
	(0.209)	(0.691)		(0.489)	(0.966)	(0.162)
ΔINF	0.551	-0.212	0.670	-	-0.717	-0.353*
	(0.584)	(0.832)	(0.506)		(0.477)	(0.057)
ΔNRR	-0.485	-0.602	-1.355	-0.500	-	-0.311***
	(0630)	(0.550)	(0.183)	(0.619)		(0.003)

Note: *** and ** denote significance at 1% and 5% levels, respectively.

Conclusion

This study reveals the link between financial globalization and financial development in the existence of economic growth, inflation, and natural resources rent for the Turkish economy using the time series with structural breaks from 1970 to 2017. The variables' unit root properties are investigated using the Ng-Perron and Vogelsang-Perron tests, and the long-run relationship between the variables is examined through the ARDL bounds test and Hatemi-J cointegration approach. The long-run elasticities are estimated using the FMOLS and CCR methods. Additionally, we apply the VECM Granger causality approach to detect the causality relations between the variables.

The findings of the ARDL bounds test and Hatemi-J cointegration technique confirm a long-run relationship between the variables under the structural breaks. The results of FMOLS and CCR techniques show that financial globalization and economic growth significantly increase financial development in Turkey, but inflation and natural resources rent reduce financial development. The VECM analysis reveals a unidirectional causality from financial globalization and economic growth to financial development. In addition, inflation and financial development cause each other. A similar result is also found between natural resources rent and financial development.

The results suggest that financial globalization has a positive impact on financial development in Turkey. This finding confirms Mishkin's idea that globalization appears to be a vital factor in stimulating the development of the financial system. The important reason for the

positive effect of globalization on financial development in the Turkish economy could be that the Turkish economy has gradually started the liberalization process since the 1980s. Especially, Turkey has revised the investment incentive schemes to stimulate investment in related sectors in 2018.

The empirical findings can present important recommendations for policymakers. The Turkish government can facilitate the entry of banking and capital market into international markets. Moreover, for foreign participants, the quality of domestic bank services could be improved, and financial costs such as credit interest rates, warranties, and guarantees could be decreased. Turkish financial institutions can also diversify their financial products. Some policy suggestions can be presented: stimulating financial integration, removing government interventions in the financial market, and implementing several reforms that corroborate international creditors' rights and the stock market operations. These developments can speed up the development of the financial sector by increasing economic growth.

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Economic Journal of Emerging Markets, 14(2) 2022, 218-230

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Available at https://journal.uii.ac.id/jep

Stock and exchange rate movements in the MENA countries: A Markov Switching –VAR Model

Marwa Trabelsi[1*], Slah Bahloul[2]

[1]Faculty of Economics and Management of Sfax, University of Sfax, Sfax, Tunisia
[2]Higher Institute of Business Administration of Sfax, University of Sfax, Sfax, Tunisia
[*]Corresponding author: tmarwa411@gmail.com

Article Info

Article history:
Received 17 September 2022
Accepted 26 October 2022
Published 27 October 2022

JEL Classification Code:
E44, F3, G15

Author's email:
Slahbahloul@gmail.com

DOI: 10.20885/ejem.vol14.iss2.art6

Abstract

Purpose — This article explores the causal link between stock and currency returns in The Middle Eastern and North African (MENA) countries from January 2011 through February 2020.

Methods — This study uses the Vector autoregressive (VAR) and the Markov switching vector autoregressive (MS-VAR) models to investigate the dynamic causality between equity and exchange rate markets.

Findings — Results indicate that this relation depends on the state of the markets. Furthermore, generally, equity returns have a significant impact on the currency markets, whatever the market state.

Implication — Regime shifts in the relationship between stock and exchange rate markets are significant for portfolio allocation because they help investors improve their investment decisions through knowledge of the dynamic link between these markets.

Originality — This study adds to the literature on the relationship between exchange rates and stock prices in the MENA countries, which have become attractive destinations for international investors due to their higher returns.

Keywords — Exchange rate, Stock market, VAR, Markov Switching VAR.

Introduction

The exchange rate controls the price of one money against another and has a major role in international finance and politics (S. Vogler, Schneider, & Zimmermann, 2019). Its crucial role in trade repeatedly puts it at the center of policy discussions. Simultaneously, stocks are the principal negotiated instruments because they are the easiest to trade and offer high returns (Syahri & Robiyanto, 2020). Thus, we can expect that excessive investment in the equity markets will lead to a rise in the demand and supply of currencies and, consequently, an interrelation between the exchange rate and stock price (Hung, 2022). Thus, it is interesting for researchers, practitioners, and policymakers to explore the dynamic connection between the equity and currency markets.

This linkage could allow policymakers to formulate appropriate policies before the crisis spreads. A link between those two markets would significantly affect economic policy and international capital planning decisions. The negative innovations that affect one market can be quickly transmitted to another through contagion effects (Chkili & Nguyen, 2014). As well as the above, the necessity of a better understanding of the financial system should be noted, especially during periods of high volatility, which can destabilize the financial system (Blau, 2018).

P ISSN 2086-3128 | E ISSN 2502-180X

Referring to the theory on the link between these two macro variables, we distinguish between two approaches. The first is the flow-oriented model implemented by Dornbusch and Fischer (1980). They consider that the exchange rate acts on the stock market prices. The second is the stock-oriented approach, defined by Branson (1981) and Frankel (1983). It states that changes in equity market prices affect exchange rates. According to the flow-oriented model, causality runs from the currency to the equity market. From this perspective, the fluctuations in the exchange rate affect international competitiveness and the trade balance. Indeed, an exchange rate appreciation implies an enhancement of the foreign currency against the domestic currency. Due to the devaluation of the national currency, the increase in exports leads to greater competitiveness. This leads to an appreciation of stock prices, which are the present value of a firm's future cash flows. For example, Aggarwal (1981) was the first to determine the interrelation between both markets in the post-Bretton Woods era, with monthly data on U.S. stock prices and effective exchange rates from 1974 to 1978. Using simple regressions, he found that equities and the value of the U.S. dollar are positively related.

Dahir, Mahat, Ab Razak, and Bany-Ariffin (2018) use the wavelet approach to examine the same relation in BRICS countries. Their findings concluded that stock markets and foreign exchange markets are strongly interconnected. Mroua and Trabelsi (2020) examine the dynamic and causal link between the U.S. dollar and the major stock indices of the BRICS nations (Brazil, Russia, India, China, and South Africa). Their findings show that exchange rate variations affect short- and long-run equity returns in every country. Salisu, Cuñado, Isah, and Gupta (2021) developed a model to study whether the differences in equity returns are predictable for BRICS exchange rates. They discovered a positive link for three of the BRICS nations: Brazil, India, and South Africa. Their findings confirm the persistence of the traditional approach of Dornbusch and Fischer (1980).

The portfolio balance and the monetary models are two sub-models of the stock-oriented approach. The portfolio balance approach (e.g., Branson (1981); Frankel (1983)) assumes that changes in the equity market affect the foreign exchange rates. A rising domestic stock price leads to a higher domestic currency with a higher interest rate, which in turn, conducts a lower exchange rate. For example, using the MS-VAR method, Korley and Giouvris (2021) explore the dynamic relationships between currency and stock price returns in sub-Saharan African (SSA) countries during higher and lower volatility periods.

Xie, Chen, and Wu (2020) examine the link between the two markets for twenty advanced and six emerging economies from January 1, 1998, to May 20, 2019, using symmetric and asymmetric bootstrap panels for Granger non-causality tests. In both periods, their outcomes show a significant causal connection between the stock and exchange rate markets. Their conclusions point to the interdependence of the equity and currency markets. This implies the transmission of a shock from one country to another.

As per the monetary approach, there is no relationship between the exchange rate and equity markets (when common factors affect the two variables). The foreign exchange rate is viewed as a relative asset price determined by expected future exchange rates (Gavin, 1989). Franck and Young (1972) are the pioneers to discover no link between the FX rate and the US stock market.

Research on the linkage between foreign currency and equity markets is limited in the MENA region. For example, Moussa and Delhoumi (2021) look at how equities, interest rates, and currency values interact in five MENA nations (Tunisia, Morocco, Egypt, Turkey, and Jordan) from June 1998 to June 2018. The Nonlinear Autoregressive Distributed Lag (NARDL) model shows that the stock index returns in the MENA region are associated with the currency and the real interest rate. Ahmed (2018) describes the link between exchange rates and equity markets in the MENA area from 2004 to 2015. Using the VECH (generalized autoregressive conditional heteroskedasticity)-GARCH model, he shows that the asymmetric relationship between these markets is more relevant in the post-2008 financial crises than in the pre-2008 financial crises. Mechri, de Peretti, and Hamad (2022) used GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model and multiple linear regression to study the interaction between equity

prices and foreign exchange rates in two MENA countries. They also compare the outcomes of the multiple regressions to those of an artificial neural network (ANN). Their results show that currency fluctuation greatly impacted equity market movements in Tunisia and Turkey. Ahmed (2019) analyzes the relationship between EGP/USD and the EGX100 index using a nonlinear distributed lag autoregressive model. He found that the currency exchange rate seems to impact equity returns in the short and long term.

Political shocks majorly impact the linkages between economic variables and can cause nonlinearities in their evolution (Arouri, Estay, Rault, & Roubaud, 2016). Referring to Salisu and Ndako (2018) and Tiryaki, Ceylan, and Erdoğan (2019), the connection between the currency exchange rates and the equity market returns requires a nonlinear framework to capture financial market volatility and structural shifts. Our study contributes to knowledge in this field and employs a dynamic strategy to explore these marketplaces, especially in the MENA region.

In previous decades, MENA economies have become attractive destinations for international investors and offer better returns[1].Referring to El-Masry and Badr (2020), foreign exchange and stock markets represent the most sensitive segments of the financial system. They are considered a barometer of a country's economic health. Thus, knowledge about the dynamic interconnectedness between foreign exchange rates and equity markets is particularly important for MENA portfolio managers. For this reason, our focus in this paper is to determine the causal relationship between foreign exchange rates and stock returns in twelve MENA countries, namely Bahrain, Kuwait, Lebanon, Qatar, Oman, Morocco, Jordan, Tunisia, Turkey, Saudi Arabia, the United Arab Emirates (U.A.E.), and Egypt in the presence of regime shift. We follow earlier studies and consider a two-state MS model; calm and crisis regimes (Chkili & Nguyen, 2014; Hung, 2022; Kanas, 2005; Korley & Giouvris, 2021; Sosa, Ortiz, & Cabello, 2018).

This study differs from earlier research in several respects. First, the Arab Spring justifies the choice of the Markov switching model. "The largest refugee catastrophe since World War II," following the World Bank. Due to its economic and social ramifications, a major political event such as this has the potential to hugely influence equity market volatility (Chau, Deesomsak, & Wang, 2014). After the Arab uprising, the MENA region's equity and currency markets have become the focus of investors' attention in the coverage of risks. In this context, the causal linkage between these markets is explained from January 2011 to February 2020. Second, this study contributes to investigating the stock price-exchange rates literature by using the Markov switching vector autoregressive (MS-VAR) model to study the interactions between the two markets across different regimes. Indeed, the coefficients of this model are market-state-dependent. Third, we use oil price as a control variable. It is considered an important factor in determining the terms of trade (Raji, Abdulkadir, & Badru, 2018). According to World Atlas[2], the MENA region contains approximately 60% of the world's oil reserves and 45 % of the world's natural gas reserves. According to Lütkepohl (1982), omitting variables leads to biased and inappropriate results about this linkage. Indeed, oil prices affect the MENA economy's stock and exchange rate markets differently. For example, the Arab Spring led to oil price shocks, while the dynamic change in oil prices led to a decline in equity and currency markets (Bildirici & Turkmen, 2015).

Methods

We first consider the linear VAR model. The relationship between foreign exchange and equity returns can be captured using this model as they change through time. Before estimation, we test the stationary of the different variables under study using the Augmented Dickey-Fuller (ADF) Unit Root Test. We also use the minimum Schwarz criterion to identify the optimal delay length for the model VAR. Results of the linear model estimation are provided in Table 2. Second, we review the nonlinear interactions between stock markets, currency exchange rates, and crude oil to report on possible structural breaks and regime changes. Table 4 shows the evaluation of the parameters of the MS-VAR model.

[1]https://www.oecd.org/mena/competitiveness/36086643.pdf
[2]https://www.worldatlas.com/

The linear Vector Autoregressive (VAR) model

We apply a VAR model to understand each country's linear interdependencies between exchange and equity returns. Given the objectives of our study, the VAR model helps us chart the interrelationships between variables in the system. The VAR model used in this survey is expressed as follows:

$$SP_t = \mathrm{Int}_1 + \sum_{i=1}^{n} \alpha_{1i}\, SP_{t-i} + \sum_{i=1}^{n} \alpha_{2i}\, ER_{t-i} + \sum_{i=1}^{n} \alpha_{3i}\, CO_{t-i} + \varepsilon_{1t} \quad (1)$$

$$ER_t = \mathrm{Int}_2 + \sum_{i=1}^{n} \alpha_{4i}\, ER_{t-i} + \sum_{i=1}^{n} \alpha_{5i}\, SP_{t-i} + \sum_{i=1}^{n} \alpha_{6i}\, CO_{t-i} + \varepsilon_{2t} \quad (2)$$

SP and ER denote each MENA country's equity and exchange rate returns, respectively. CO is the crude oil return.$\varepsilon_{1t}$and$\varepsilon_{2t}$are the vectors of error terms.

The nonlinear Markov-Switching Vector Autoregressive (MS-VAR) model

The MS-VAR model can predict the connection between the equity price and foreign exchange over time, given a specific transition probability. This model was created in its original form by Krolzig (1997) and can be stated as follows:

$$SP_t = \mathrm{Int}_1(S_t) + \sum_{j=1}^{p} a_{1j}(S_t)\, SP_{t-j} + \sum_{j=1}^{p} a_{2j}(S_t)\, ER_{t-j} + \sum_{j=1}^{p} a_{3j}(S_t)\, CO_{t-j} + \varepsilon_{1t} \quad (3)$$

$$ER_t = \mathrm{Int}_2(S_t) + \sum_{j=1}^{p} a_{4j}(S_t)\, ER_{t-j} + \sum_{j=1}^{p} a_{5j}(S_t)\, SP_{t-j} + \sum_{j=1}^{p} a_{6j}(S_t)\, CO_{t-j} + \varepsilon_{2t} \quad (4)$$

S_t is an unobservable variable tested by a second-order Markov process. It is considered to be a two-state first-order Markov process with a transition probability matrix displayed as follows:

$P_{ij} = P[S_t = j\ /S_{t-1} = i]$ With $\sum_{j=1}^{2} p_{ij} = 1$ for all i, j$\epsilon\{1,2\}$

$$\mathrm{P}=\begin{bmatrix} P_{11} & P_{21} \\ P_{12} & P_{22} \end{bmatrix} \text{ where } \begin{cases} P_{11} = P[S_t = 1/S_{t-1} = 1] \\ P_{12} = 1 - P_{11} = P[S_t = 2/S_{t-1} = 1] \\ P_{21} = 1 - P_{22} = [S_t = 1/S_{t-1} = 2] \\ P_{22} = P[S_t = 2/S_{t-1} = 2] \end{cases} \quad (5)$$

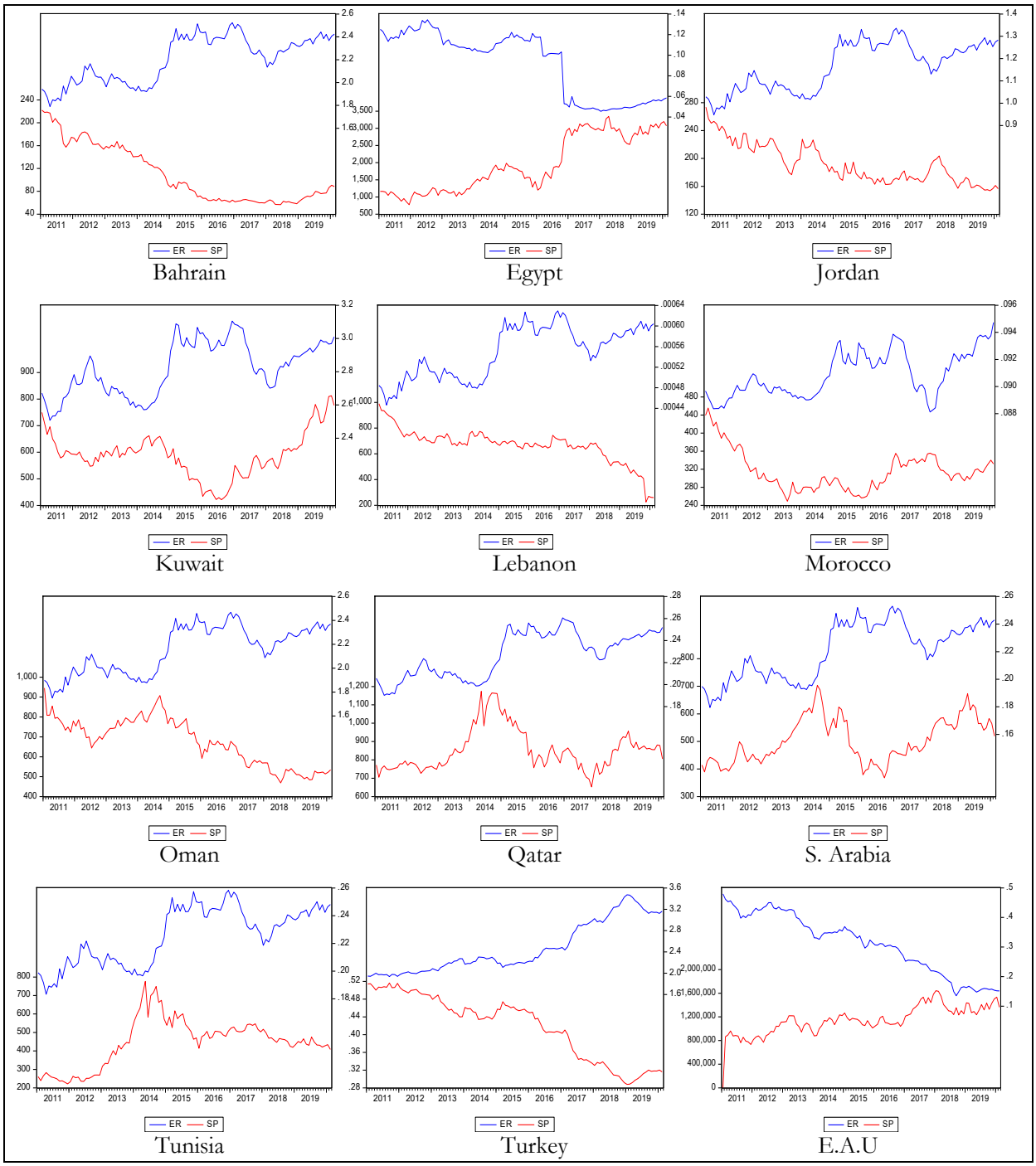
Furthermore, the transition probabilities give us information about the expected duration, which is the time required for the system to remain in a specific regime. Therefore, the expected duration is specified as follows:

$$\mathrm{E(d)}=\frac{1}{1-P_{ij}}\text{ , where i =1,2 ; j=1,2} \quad (6)$$

Data description

This paper utilizes monthly data for twelve MENA countries, namely, Bahrain, Jordan, Kuwait, Lebanon, Saudi Arabia, Qatar, Oman, Morocco, Tunisia, Turkey, U.A.E., and Egypt, from January 2011 to February 2020. Stock price indices expressed in local currencies are obtained from the MSCI (Morgan Stanley Capital International) database. The crude oil price in the U.S. dollar per barrel and the nominal exchange rates in local currency against the euro are from the DataStream. Monthly returns are calculated using the difference in the logarithm of two successive prices. They are then multiplied by 100.

Descriptive statistics for all data sets are summarized in Table 1. Panel A of Table 1 shows that Egypt has the highest mean stock market return with a value of (0.801). Lebanon has the lowest (-1.147). Concerning volatility, the Moroccan stock return has the lowest standard deviation (3.340), while the UAE equity market has the highest volatility (7.057). Currency exchange rate volatility varies from (0.423) for Morocco to (2.626) for Egypt. Panel B of table 1 shows that Tunisia seems to have suffered the largest currency losses, while Turkey experienced the most volatile currency changes during the sample period.



Notes: The figure displays the historical time series of the stock price index and exchange rate of the twelve MENA markets.

Figure 1. Time series of the data

Table 1. Descriptive statistics

	Mean	Std. Dev.	Skewness	Kurtosis	J.B.	Prob.	ADF (t-stat.)	Prob.	LB^2	Prob.
Panel A: Stock market index returns										
Bahrain	-0.860	4.971	-0.202	4.249	7.898	0.019	-11.012	0.000	6.1223	0.634
Egypt	0.801	5.923	0.185	2.348	2.573	0.276	-10.340	0.000	19.044	0.015
Jordan	-0.834	3.940	0.255	2.763	1.451	0.484	-11.228	0.000	7.1820	0.517
Kuwait	-0.042	4.125	0.206	2.797	0.964	0.617	-8.944	0.000	12.230	0.141
Lebanon	-1.147	3.416	0.057	2.569	0.911	0.634	-11.500	0.000	6.9107	0.546
Morocco	-0.204	3.340	0.090	2.649	0.713	0.700	-10.024	0.000	7.2121	0.514
Oman	-0.364	3.991	-0.224	3.126	0.989	0.610	-12.084	0.000	14.478	0.070
Qatar	0.394	4.279	0.048	2.837	0.164	0.921	-9.266	0.000	18.631	0.017

	Mean	Std. Dev.	Skewness	Kurtosis	J.B.	Prob.	ADF (t-stat.)	Prob.	LB^2	Prob.
Panel A: Stock market index returns										
S. Arabia	0.082	4.947	-0.143	3.245	0.652	0.722	-8.761	0.000	12.564	0.128
Tunisia	0.206	3.453	-0.303	3.605	3.358	0.187	-9.196	0.000	11.294	0.186
Turkey	0.479	6.375	-0.087	2.268	2.592	0.274	-11.178	0.000	5.6477	0.687
U.A.E	0.335	7.057	-0.269	5.011	19.869	0.000	-12.569	0.000	27.971	0.000
Panel B: Exchange rate returns										
Bahrain	0.179	2.294	0.498	3.429	5.390	0.068	-11.390	0.000	12.013	0.151
Egypt	-0.206	2.626	-0.577	4.829	21.436	0.000	-9.084	0.000	13.794	0.087
Jordan	0.017	2.083	0.134	2.594	1.088	0.580	-10.633	0.000	16.700	0.033
Kuwait	0.069	1.361	0.146	3.359	0.978	0.613	-7.688	0.000	11.881	0.157
Lebanon	0.179	2.295	0.501	3.435	5.474	0.065	-11.397	0.000	12.076	0.148
Morocco	0.031	0.423	0.077	2.703	0.511	0.775	-8.036	0.000	15.389	0.052
Oman	0.179	2.294	0.501	3.438	5.474	0.065	-11.395	0.000	12.124	0.146
Qatar	0.175	1.768	0.415	3.588	4.735	0.094	-7.687	0.000	10.953	0.204
S. Arabia	0.129	2.200	0.349	3.172	2.365	0.307	-11.869	0.000	24.411	0.002
Tunisia	0.453	1.613	-0.075	3.815	3.149	0.207	-8.372	0.000	21.691	0.006
Turkey	-0.874	2.325	0.081	2.265	2.601	0.272	-7.678	0.000	24.353	0.002
U.A.E	0.179	2.295	0.501	3.435	5.472	0.065	-11.398	0.000	12.086	0.147
Panel C: Crude Oil price changes										
	-0.429	9.469	-0.022	3.408	0.771	0.680	-9.963	0.000	13.538	0.095

Notes: Jarque-Bera (JB) is a normality test statistic. In the squares of the returns up to the eight orders, LB is the Ljung–Box Q-statistic. The Augmented Dickey-Fuller unit root tests (ADF) are a type of unit root test.

Results and Discussion

Linear VAR model results

Table 2. Linear VAR estimation results

	Bahrain		Egypt		Jordan		Kuwait		Lebanon		Morocco	
	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER
Intercept	-0.877	0.266	0.808	-0.160	-0.540	0.203	-0.098	0.055	-1.293	0.151	-0.505	-0.036*
	(0.489)	(0.222)	(0.585)	(0.255)	(0.420)	(0.223)	(0.394)	(0.126)	(0.348)	(0.233)	(0.351)	(0.052)
SP_{t-1}	-0.014	0.069**	-0.006*	0.023**	-0.174*	-0.024**	0.175*	0.032**	-0.088*	-0.058*	0.172*	0.006**
	(0.104)	(0.047)	(0.099)	(0.043)	(0.096)	(0.051)	(0.098)	(0.032)	(0.097)	(0.065)	(0.096)	(0.014)
ER_{t-1}	0.196	-0.074*	0.024	0.153*	-0.234	-0.117*	0.028	0.266*	0.047	-0.114*	0.068	0.222*
	(0.218)	(0.099)	(0.224)	(0.097)	(0.187)	(0.099)	(0.293)	(0.094)	(0.147)	(0.098)	(0.656)	(0.098)
CO_{t-1}	0.039*	-0.023**	-0.010*	0.008**	0.046*	-0.021**	0.013**	-0.013**	-0.028**	-0.012**	-0.035**	0.005***
	(0.054)	(0.024)	(0.062)	(0.027)	(0.053)	(0.028)	(0.042)	(0.013)	(0.035)	(0.024)	(0.044)	(0.007)
Log-likelihood	-328.780		-348.543		-929.552		-883.808		-925.802		-753.229	

	Oman		Qatar		S. Arabia		Tunisia		Turkey		U.A.E	
	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER
Intercept	-0.609	0.245	0.301	0.131	0.122	0.173	0.278	0.346	0.400	-0.683	0.582	0.211
	(0.397)	(0.222)	(0.415)	(0.165)	(0.475)	(0.212)	(0.322)	(0.160)	(0.669)	(0.224)	(0.671)	(0.223)
SP_{t-1}	-0.210*	0.064**	0.117*	0.009**	0.148*	-0.015**	0.159*	0.010**	-0.067	0.061**	-0.226	0.009**
	(0.095)	(0.053)	(0.099)	(0.040)	(0.099)	(0.044)	(0.090)	(0.045)	(0.103)	(0.035)	(0.101)	(0.033)
ER_{t-1}	0.194	-0.108*	0.164	0.260*	-0.164	-0.136*	-0.059	0.214*	-0.058	0.251*	-0.396	-0.098
	(0.176)	(0.098)	(0.236)	(0.094)	(0.217)	(0.097)	(0.195)	(0.097)	(0.276)	(0.093)	(0.305)	(0.101)
CO_{t-1}	0.151*	-0.028**	-0.060**	-0.026**	-0.004*	0.002**	-0.068**	-0.007**	-0.107*	-0.058**	0.034*	-0.014**
	(0.051)	(0.029)	(0.045)	(0.018)	(0.052)	(0.023)	(0.033)	(0.017)	(0.066)	(0.022)	(0.073)	(0.024)
Log-likelihood	-922.574		-915.059		-955.752		-881.790		-982.563		-995.011	

Notes: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 2 shows the findings of the VAR model. This table shows the coefficient estimates relating a set of current returns to a period of lagged returns between currency exchange rates and equities prices, suggesting some predictability of these markets based on returns. There is unidirectional causality from equity to foreign exchange rates in all nations in the sample. Consequently, all countries adhere to the portfolio approaches. These findings can be interpreted

as the outcome of the effect of equity on the foreign exchange due to the increase in inflation expectations induced by stock markets, which puts pressure on the domestic currency. The local currency appreciates as a finding of the demand pressure. These results support Xie et al. (2020); Andriansyah and Messinis (2019), which provided evidence for this approach. As presented in Table 3, the crude oil coefficient is significant for all exchange rate markets. This can be construed as the rise in oil prices trade has put pressure on the current account and led to exchange rate fluctuations (Bal & Rath, 2015).

Moreover, all stock prices are significantly impacted by crude oil. This implies that MENA stocks are sensitive to crude oil price movements. The results discussed below, however, are flawed in that they were derived from the estimation of a linear model, where the parameters are assumed to be constant, and they do not account for regime changes that could lead to fluctuating levels of uncertainty in a regime. We then allow nonlinear interactions between two financial markets.

Regime-shifting behavior of stock markets in MENA countries

Before applying the MS-VAR method, we check whether stock returns exhibit regime-switching behavior. For this purpose, we use the likelihood ratio test calculated as follows:

$$LR = 2\times \mid lnL_{MS\_AR} - lnL_{AR} \mid \quad (7)$$

Where lnL is the log-likelihood of the competing models (e.g., Hung, 2020; Korley & Giouvris, 2021), the critical values are based on Garcia (1998). Table 3 shows that the LR test statistics are significant at the 1% level in all stock returns. Thus, it is clear that there is solid proof of regime change in MENA stock returns. This outcome agrees with previous studies (see.g., Hung, 2020; Sosa et al., 2018). This behavior is not surprising and can be explained theoretically by the changing economic structure of these markets, especially after the Arab Spring. Al-Muharrami (2015), Chau et al. (2014), and Ghosh (2016) studies consistently show that the Arab Spring protests significantly affect stock market performance.

Table 3. LR test statistic results.

	L(AR)	L(MSR)	LR
Bahrain	-329.402	-319.402	19.754*
Egypt	-348.564	-337.305	22.519*
Jordan	-303.801	-281.127	45.348*
Kuwait	-306.582	-294.648	23.868*
Lebanon	-287.659	-278.083	19.150*
Morocco	-285.532	-274.762	21.539*
Oman	-304.049	-294.695	18.707*
Qatar	-312.609	-300.244	24.730*
S. Arabia	-327.237	-316.372	21.729*
Tunisia	-282.538	-267.153	30.769*
Turkey	-355.943	-342.027	27.832*
U.A.E	-365.183	-354.490	21.386*

Notes: Critical value of Garcia (1998) is 17.52 for α=1%. "*" Denotes significance at 1% level.

Dynamic relationships between equity and currency markets

Table 4 shows the MS-VAR estimation results, which explicitly analyze the interactions between currency exchange rates and equity returns in MENA countries. Volatilities are higher in regime 2 compared to regime 1. These outcomes indicate that the first regime can be described as a "calm regime" and the second "crisis regime. The crisis regime (regime 2) is more enduring than the first one for most markets. Indeed, the average duration $E(d_2)$ of the crisis regime is higher than that of the calm regime (regime 1) in most countries (equation 6). Table 4 also shows that the coefficient estimates are more significant, especially under quiet conditions. In this earlier regime, the impact of equity returns on currency movements is significant for Egypt, the UAE, Tunisia, and Turkey.

Table 4. Estimation results of the MS-VAR model.

	Bahrain		Egypt		Jordan		Kuwait	
	SP	ER	SP	ER	SP	ER	SP	ER
				Calm regime				
$Intercept_1$	-0.05	0.05	1.45	0.8***	-1.02*	-0.11	-0.34	0.02
	(0.89)	(0.83)	(0.19)	(0.00)	(0.09)	(0.82)	(0.38)	(0.85)
SP_{t-1}	-0.01	0.03	-0.02	0.11**	0.58***	0.15	0.32***	0.03
	(0.98)	(0.59)	(0.92)	(0.02)	(0.00)	(0.21)	(0.00)	(0.36)
ER_{t-1}	-0.12	-0.07	0.06	-0.27*	-0.29	-0.01	-0.06	0.34***
	(0.73)	(0.63)	(0.92)	(0.06)	(0.42)	(0.98)	(0.83)	(0.00)
CO_{t-1}	-0.01	0.03	-0.04	0.02	-0.05	0.05	0.03	-0.02
	(0.99)	(0.17)	(0.66)	(0.37)	(0.69)	(0.47)	(0.49)	(0.13)
σ_1^2	21.283***	3.096***	30.415***	1.472***	5.991***	3.420***	13.167***	1.460***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
				Crisis regime				
$Intercept_2$	-1.51**	0.45	0.56	-0.24	-0.84*	-0.01	-0.05	0.09
	(0.04)	(0.19)	(0.46)	(0.51)	(0.09)	(0.99)	(0.99)	(0.89)
SP_{t-1}	-0.03	0.16**	-0.03	0.03	-0.19	0.02	-0.28	0.06
	(0.86)	(0.03)	(0.81)	(0.6)	(0.12)	(0.7)	(0.23)	(0.49)
ER_{t-1}	0.39	-0.08	0.02	0.17	-0.02	-0.01	0.11	-0.09
	(0.16)	(0.53)	(0.94)	(0.17)	(0.91)	(0.99)	(0.90)	(0.74)
CO_{t-1}	0.07	-0.12**	-0.07	0.02	0.02	-0.02	-0.01	0.01
	(0.44)	(0.01)	(0.43)	(0.71)	(0.63)	(0.91)	(0.98)	(0.77)
σ_2^2	23.877***	5.455***	37.297***	8.502***	17.138***	4.178***	24.754***	2.707***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)
P_{11}	0.98***		0.96***		0.87***		0.98***	
	(0.00)		(0.00)		(0.00)		(0.00)	
P_{22}	0.97***		0.97***		0.95***		0.93**	
	(0.01)		(0.00)		(0.00)		(0.01)	
E(d_1)	54.2		23.48		7.72		65.23	
E(d_2)	45.94		30.1		19.22		13.76	
Log(L)	-946.7604		-983.7932		-918.781		-874.3499	

	Lebanon		Morocco		Oman		Qatar	
	SP	ER	SP	ER	SP	ER	SP	ER
				Calm regime				
$Intercept_1$	0.8	-0.22	-0.46	0.02	1.26**	-0.16	0.31	0.14
	(0.18)	(0.73)	(0.2)	(0.68)	(0.02)	(0.62)	(0.32)	(0.63)
SP_{t-1}	0.02	0.06	0.14	-0.01	-0.09	0.1	-0.21	-0.01
	(0.86)	(0.65)	(0.19)	(0.6)	(0.6)	(0.52)	(0.25)	(0.99)
ER_{t-1}	0.06	0.08	-0.1	0.51***	0.02	0.01	-0.15	0.09
	(0.68)	(0.75)	(0.91)	(0.00)	(0.98)	(0.94)	(0.51)	(0.55)
CO_{t-1}	-0.02	0.02	-0.06	-0.01*	-0.04	0.06	0.05	-0.07
	(0.64)	(0.76)	(0.11)	(0.06)	(0.65)	(0.61)	(0.27)	(0.15)
σ_1^2	2.982***	3.107***	9.637***	0.116***	6.307***	2.755*	4.439***	2.505***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.00)	(0.00)
				Crisis regime				
$Intercept_2$	-1.74***	0.15	0.9	-0.01	-1.06**	0.45	0.4	0.18
	(0.00)	(0.54)	(0.35)	(0.92)	(0.02)	(0.12)	(0.49)	(0.39)
SP_{t-1}	-0.05	-0.13*	-0.15	-0.07**	-0.25**	0.06	0.15	0.01
	(0.62)	(0.05)	(0.55)	(0.02)	(0.02)	(0.4)	(0.21)	(0.92)
ER_{t-1}	0.06	-0.14	-0.01	-0.27	0.14	-0.12	0.15	0.37***
	(0.68)	(0.17)	(0.99)	(0.17)	(0.43)	(0.3)	(0.64)	(0.00)
CO_{t-1}	-0.02	-0.02	0.08	0.01	0.15***	-0.02	-0.09	-0.01
	(0.64)	(0.53)	(0.24)	(0.32)	(0.00)	(0.48)	(0.13)	(0.9)
σ_2^2	12.330***	4.977***	13.024***	0.171**	14.607***	5.71***	23.667***	2.919***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
P_{11}	0.91*		0.94***		0.93***		0.93***	
	(0.05)		(0.00)		(0.00)		(0.00)	
P_{22}	0.97***		0.77*		0.98***		0.97***	
	(0.00)		(0.09)		(0.00)		(0.00)	
E(d_1)	1.03		17.9		14.47		14.79	
E(d_2)	10.65		4.32		57.92		32.79	
Log(L)	-903.3845		-725.4658		-916.2205		-900.7851	

	S. Arabia		Tunisia		Turkey		U.A.E	
	SP	ER	SP	ER	SP	ER	SP	ER
				Calm regime				
$Intercept_1$	-0.02	-0.18	-0.14	-0.33*	0.05	-0.09	1.28*	-0.06
	(0.98)	(0.65)	(0.73)	(0.05)	(0.92)	(0.48)	(0.05)	(0.77)
SP_{t-1}	-0.07	-0.05	-0.11	-0.12*	-0.45***	0.03*	0.04	0.08*
	(0.7)	(0.63)	(0.49)	(0.09)	(0.00)	(0.07)	(0.76)	(0.07)
SP_{t-2}			-0.24	0.01				
			(0.15)	(0.9)				
ER_{t-1}	0.24	-0.15	-0.08	0.46**	0.1	-0.71***	-0.72*	0.1
	(0.54)	(0.52)	(0.85)	(0.02)	(0.75)	(0.00)	(0.05)	(0.42)
ER_{t-2}			0.48	0.02				
			(0.22)	(0.89)				
CO_{t-1}	0.04	-0.01	0.15**	0.01	-0.49***	-0.06***	-0.11	-0.03
	(0.76)	(0.94)	(0.01)	(0.69)	(0.00)	(0.00)	(0.18)	(0.32)
CO_{t-2}			0.01	-0.03				
			(0.94)	(0.13)				
σ_1^2	11.502***	3.456***	2.676***	0.387***	2.241**	0.114*	25.767***	2.794***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.03)	(0.05)	(0.00)	(0.00)
				Crisis regime				
$Intercept_2$	-0.04	0.49*	0.26	0.5**	0.01	-0.85***	-2.72*	0.92*
	(0.91)	(0.09)	(0.51)	(0.01)	(0.97)	(0.00)	(0.07)	(0.07)
SP_{t-1}	0.23*	0.01	0.19*	0.07	0.05	0.1**	-0.38**	-0.06
	(0.07)	(0.98)	(0.07)	(0.18)	(0.68)	(0.01)	(0.01)	(0.31)
SP_{t-2}			0.14	0.01				
			(0.18)	(0.95)				
ER_{t-1}	-0.28	-0.21*	-0.12	0.14	-0.01	0.29***	-0.17	-0.24
	(0.33)	(0.08)	(0.59)	(0.21)	(0.99)	(0.00)	(0.72)	(0.16)
ER_{t-2}			0.11	0.14				
			(0.62)	(0.21)				
CO_{t-1}	0.03	0.01	-0.11***	-0.01	-0.03	-0.04*	0.01	0.01
	(0.63)	(0.79)	(0.00)	(0.72)	(0.67)	(0.06)	(0.94)	(0.93)
CO_{t-2}			0.01	0.04*				
			(0.95)	(0.07)				
σ_2^2	29.611***	4.860***	9.946***	2.517***	39.020***	3.908***	68.115***	8.815***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
P_{11}	0.91***		0.81***		0.8*		0.99***	
	(0.00)		(0.00)		(0.08)		(0.00)	
P_{22}	0.96***		0.95**		0.89***		0.95***	
	(0.00)		(0.04)		(0.00)		(0.00)	
E(d_1)	10.55		5.38		1.25		85.51	
E(d_2)	26.29		18.98		9.31		20.61	
Log(L)	-943.4875		-861.7698		-978.064		-986.693	

Notes: ***, ** and * denote significance at the 1%, 5%, and 10% levels, respectively.

This evidence can be explained by a low level of growth as well as by high inflation experienced by Egypt, Tunisia, and Turkey, especially since 2016, which has led to a sharp depreciation of their national currencies against the reference currencies (Alpha MENA, 2021)[3]. As international investors have mostly ignored MENA stock markets due to trading restrictions, this circumstance may inspire foreign investors who are not risk-averse to convert their currencies and participate in MENA stock markets. As a result of this intervention, stock prices increase, increasing national investors' wealth. Consequently, the value of the currency has increased. This result supports the theoretical prediction of the stock-oriented models. Our result is in accordance with Roubaud and Arouri (2018) and Sosa et al. (2018). There is also interaction for the crisis regime that leads from equity markets to currency exchange rates in Bahrain, Lebanon, Morocco, and Turkey. We note that an unstable environment is favorable for stock market investment in these MENA countries. Indeed, investors are confident about the opportunities in MENA equities. This is similar to that of Ahmed (2019) and Hung (2020).

[3] https://www.tustex.com/bourse-divers/les-rendements-des-actifs-en-tunisie-turquie-et-egypte-compares-par-alphamena

Additionally, we examine how exchange rate returns affect stock market returns. We show that this impact is negligible in both regimes, except for the calm regime in the UAE. So, we notice that stock returns in this country are more susceptible to exchange rate fluctuations. This evidence shows that investors can better predict UAE stock price movements based on foreign exchange fluctuations. Indeed, this stock market will attract foreign portfolio investment, leading to a rise in the value of the national currency. This result supports the theoretical prediction of the flow-based models.

From table 4, we generally note that equity markets are less affected by currency exchange rate fluctuations. This is an indication that the fluctuation of EUR exchange rates does not have a strong influence on the stock return dynamics. Similarly, Hung (2020) confirms that equity returns have a stronger impact on currency returns. In general, our findings are affected by political instability. The Arab Spring in the MENA zone has caused delays in investment decisions. This causes the euro to appreciate against the national currency and a slowdown in export orders. These indicators suggest that asset values in these countries are contagious. This turbulent period has influenced investor behavior.

Table 4 shows the impact of oil on foreign exchange fluctuations and equity returns under calm and crisis states. In many countries, this impact is higher during a crisis state than during a calm one. This is because the economic conditions of these countries are affected by the "Arab Spring ." This finding, which confirms the result of previous studies (see, e.g., Al-Qaralleh, 2020; Nouira, Amor, & Rault, 2019), can be justified by the fact that investors' behavior is related to the evolution of oil prices because fluctuations in crude oil have a direct impact on corporate cash flows and equity market value (Mensi, Reboredo, & Ugolini, 2021). This linkage is sensitive to oil shocks.

Conclusion

In this work, we determine the interactions between equity and currency markets for twelve MENA countries in a stable and regime-change environment. Specifically, the paper addresses the direction of causality between the two markets in a linear framework and regime-switching behavior in MENA equity markets. In addition, the paper confirms whether the movements between currency exchange rates and equity markets are stronger in times of crisis than in calm ones. We have determined the direction of causality between the financial markets using a linear VAR. From the limits of the linear model, we consider the changes in a regime that can affect the causal relationships between the markets considered. We have calculated the LR test to detect regime-switching behavior in the equity returns of MENA markets and provide evidence of the presence of two distinct regimes for all equity markets, calm and crisis states. We also used the MS-VAR model to analyze the relationship between the currency exchange rate and equity markets. The persistence of two different regimes for all markets, namely low and high volatility regimes, has been detected. The high volatility regime has more persistence than the low volatility regime. The results show that equity market returns significantly impact currency exchange returns for some countries in both regimes. However, foreign exchange markets impact the stock market only for the UAE in the quiet regime. Finally, our findings are of interest to economic policymakers, hedgers who would be able to use appropriate hedging strategies to protect themselves against market risks in future crises, and portfolio managers who want to diversify their portfolios and invest in different asset classes in the currency and equity markets. Before investing in a portfolio, it is important to comprehend the time-varying relationships between equities and currencies when considering investments in MENA countries. Within the regime-switching framework, this study contributes to a deeper comprehension of the relationship between equities and currencies in MENA countries.

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Economic Journal of Emerging Markets, 14(2) 2022, 231-243

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Economic Journal of Emerging Markets
Available at https://journal.uii.ac.id/jep

The effects of foreign direct investment and trade openness on economic growth amid crises in Asian economies

Rabiul Hossain*[1], Chandan Kumar Roy[2], Rima Akter[3]

[1,2]Bangladesh Bank, Dhaka, Bangladesh
[3]China Institute of WTO Studies, University of International Business and Economics, Beijing, China
*Corresponding author: rabiul_phd@yahoo.com

Article Info

Article history:
Received 6 June 2022
Accepted 28 October 2022
Published 28 October 2022

JEL Classification Code:
F21, F43, F62, C13

Author's email:
rabiul_phd@yahoo.com
chandan_hstu@yahoo.com
rima.wto@gmail.com

DOI: 10.20885/ejem.vol14.iss2.art7

Abstract

Purpose — The main objective is to examine the effects of foreign direct investment and trade openness on economic growth (SDG-8.1) about economic growth amid crises in 30 Asian economies.

Design/methodology/approach — The effects of FDI and trade openness on economic growth in the Asian region are examined using the fixed-effects model, panel corrected standard errors (PCSE), and generalized method of moments (GMM) estimations. The study also measures the long-run effects of the estimates and the granger causality tests.

Findings — The findings revealed that both FDI and trade openness contribute to boosting economic growth in Asian economies, and the effect is also persistent in the long run. We also find that the Asian and global financial collapse shocks in 1997-1998 and 2008-2009, respectively, adversely affected the region's economic growth. Additionally, the economic growths of some Asian countries are below the targeted level set in SDG-8.1.

Practical implications — The Asian countries should adopt appropriate policy measures for encouraging the inflow of FDI and cross-border trade of goods and services as it is evident that the inflow of FDI and open trade will improve local human capital and technological capabilities of the industries, which will ultimately help to enhance stable economic growth.

Originality/value — This study is unique in accompanying the Asian financial crisis and world recession in studying the effects of FDI and trade openness on SDG-8.1 in Asian economies.

Keywords — Foreign Direct Investment; Trade Openness; Sustainable Development Goal; Economic Growth

Introduction

Sustainable development is now the buzzword for creating a healthy and beautiful future for the coming generations. It is a way of ensuring balanced and livable earth for the creations living in it. The sustainable development goals (SDGs) or 2030 agenda were embraced by all United Nations (UN) member countries in 2015, comprising 17 goals to be achieved by 2030 based on countries' collective efforts and individual endeavors. One of the essential goals of SDGs is SDG-8 (sustained growth) which the countries must achieve to ensure sustainable development. Currently, Asia and

P ISSN 2086-3128 | E ISSN 2502-180X

the Pacific region are the utmost burgeoning economic constituency of the world. The region contributes to half of the world's GDP and one-third of global output, which paved the way for emancipating around 700 million people living in this region from poverty. So, to ensure sustainable development in Asia, there must have sustainable economic growth. Policymakers argue that foreign direct investment (FDI) and international trade can significantly affect the development effort. In addition to the movement of capital and goods and services between nations, both FDI and trade act as a prime source of crucial technical know-how and human capital development, which help the economy to achieve high growth. Based on these arguments, economies offer various incentives and policy relaxations to encourage FDI and open trade in their countries.

Foreign direct investment (FDI) and trade openness (TO) are essential drivers of economic growth. Over the years, several studies have focused on the effect that FDI and TO may exert on sustainable development, along with their causal relationship. The relationships among these three macroeconomic indicators have shown mixed evidence in the existing studies. Moreover, the causal link between the growth and FDI or TO and the reverse relationship between the variables required further attention. More specifically, the current paper is limited to the selected issue in the case of the Asian region. Thus, this study aims, in a broad aspect, to estimate the sustainability of Asian economies by exploring the outcomes of FDI and trade openness on sustainable economic growth, both in the short and long run. In addition, we consider two major crises, the Asian financial crisis, and the global financial crisis, in the growth model to find the exact impact of economic recession, FDI, and TO on growth in Asia. Previous studies did not consider the recession factors to measure the impact of FDI and TO on growth. Further, we employed a longer dataset of 27 years than existing studies of 30 Asian economies. We used panel data fixed-effects model, difference and system GMM estimation proposed by Arellano and Bond (1991) and Arellano and Bover (1995), long-run estimation of coefficients, and granger causality tests to produce more robust estimates, which is an almost new contribution to the existing literature.

Asian economic growth has been above the world's economic growth rate from 1991 to 2017. However, this growth shows two slumps due to the Asian financial crisis and the world recession. The Asian financial crisis resulted from currency devaluations in the South-East Asian nations in 1997. Due to the financial crisis in Asia, the flow of FDI and the economic growth rate of Asian economies dropped significantly as the crisis reached its peak. Consequently, other Asian and non-Asian countries also were affected by this crisis. South Korea, Malaysia, the Philippines, Indonesia, and Thailand were badly affected nations.

After the Great Depression of the 1930s, 2008-2009 was the most severe global financial crisis as it lasted from December 2007 to June 2009. With a global recession, consumption in the US decreased, and the savings rate increased, which affected global growth because US consumers consume more than any other country, which is the primary source of demand for many countries. The Arab countries entered the crisis due to the fall of oil prices in the world trade markets, and most Asian regions were much affected by the global recession. So, with data from various sources, we see that Asia has diverse experiences due to the world recession in 2008-2009. China's GDP growth for 2008, anticipated by the IMF, was 9.7%, reduced to 8.5% in 2009. The economy of Hong Kong slid into a downturn in the last quarter of 2008 and was determined to develop at 2% in 2009. The administration of Taiwan pronounced to reduce government expenditures and burn through billions of dollars due to falling growth and encountered a fall of 26% in the financial exchange market values in 2008. In the second quarter of 2008, the economy of Japan shrank by 0.6%, and in 2009 Malaysia experienced a shrinkage of its GDP by 1.7%. India had a minimal effect of recession as the export contains only 15% of its GDP, and it experienced a growth rate of 6.7% in the 2008-2009 FY. Bangladesh also showed strong economic growth and was thought not to be affected by the recession. The Philippines was thought to reverse the outcomes of the recession, and it recorded positive economic growth in 2009.

Since the opening up of China's domestic market, the flow of FDI has been increasing into the Asian region. India also offers a wide variety of services which paved the way for India to attract FDI. Accordingly, Japan offers industrial machinery and electric parts to the world. Now, Vietnam

and Bangladesh produce garments products at lower costs than China. Middle Eastern countries supply most of the world's crude oil and earn the FDI in oil-intensive industries.

The increased flow of FDI creates spillover effects by improving human capital and assimilating newer technologies. Moreover, foreign direct investment flow and stock, international trade flow, bulk production, and improved R&D ensure the quality and variety of products. Moreover, the flow of FDI among the Asian economies is also rising.

As WTO has been trying to ensure tariff and restriction-free trade worldwide, world trade in merchandise and services has been increasing, and trade openness is also seeing an upward trend. Soon after joining the WTO in 1995, trade openness among countries increased substantially. From the inception of SDG targets, various international bodies, researchers, and academicians have evaluated its progress towards its final achievement. Countries adopting SDG targets have taken several measures to reach the expected SDG goals. So, the effectiveness of those measures is appraised by the level of achievement in different analyses. We have now focused on the participating countries' position on SDG achievement to show the progress of the Asian economies for the time being.

From the beginning of SDGs, participating member countries have committed to devoting their efforts to achieving the destined targets within the stipulated time. As the SDG targets are fixed to achieve by 2030, Asian economies have made several determinations by this time and have shown constant progress towards achieving goals. For the economic progress in SDG-8.1.1, LDCs have a fixed target of 7% of real GDP to be achieved by 2030 to ensure sustainable growth in the world. Asian economies have continuously advanced towards SDG goals by the end of 2018. Though few countries only achieved the landmark of 7% of real GDP, most nations are on track to boost economic growth to the expected level, but some Asian economies are lagging in that perspective. So, it reminds us to bolster and strengthen the efforts towards increasing real GDP in Asian economies. Having experienced more FDI flows, increased volume of trade in merchandise and services, and more openness to trade, Asia has been growing more rapidly than any other region.

Literature Review

Foreign Direct Investment (FDI)-Economic Growth Nexus

Foreign Direct Investment (FDI) has played an optimistic and noteworthy role in the host economy by creating spillover effects. FDI has also increased aggregate production in the recipient country by combining labor and physical capital. So, FDI rests a mark on economic growth in the recipient country directly via ensuring capital stock and indirectly through ensuring human capital development and upgrading technology. Chaudhury, Nanda, and Tyagi (2020) identified the impact of FDI on the economic growth of South Asian countries for the period of 1990 to 2014. They found that the sectoral composition of FDI influences the impacts of FDI in South Asian countries. Ridzuan, Ismail, and Hamat (2018) explored the impression of FDI and trade openness on sustainable development in Malaysia using data from 1970 to 2013. Results show that FDI positively affects economic growth; it causes better income distribution and lowers carbon emissions, but trade openness leads to higher growth, better income distribution, and an insignificant environmental impact. The mixed findings suggested that Malaysian policymakers revisit existing policies, pay more attention to attracting FDI, and scrutinize the trade openness matters to ensure sustainable development by achieving SDGs.

Armeanu et al. (2018) investigated the sustainable economic growth drivers of 28 European countries from 2002 to 2012. They examined several drivers of economic growth and got the negative association of economic growth sustainability with science and technology graduates, corruption perceptions index, infrastructures, and old-age dependency ratio. In contrast, there is positive association of sustainable economic growth with traditional 18-22-year-old students and expenditure per student in higher education, total expenditure on research and development and employment rates of recent graduates. Considering the Asian Financial Crisis, several studies such as Kizilkaya, Ahmet, and Akar (2016) for 39 countries, Baharumshah and Almasaied (2009) for Malaysia, and Acharyya (2009) for India have reported FDI impact on economic growth is positive and significant.

Several studies have found an optimistic but statistically insignificant relationship between FDI and growth. Makki and Somwaru (2004) identified the influence of Foreign Direct Investment

and trade on economic growth from the perspective of 66 developing countries from 1971 to 2000 using the seemingly unrelated regression (SUR) model with three equations for cross-country analysis. The results exhibited that trade and FDI positively contributed toward advancing growth, but their effects on growth are insignificant. FDI and trade showed a strong connection, and their interaction effects are momentous in impacting growth. Using panel data approaches, Kotrajaras (2013) tried to identify the effect of FDI on economic growth by conducting research on15 East-Asian nations from 1990 to 2009. The results showed mixed nature where FDI has positive and significant consequences on economic growth in high and middle-income economies. However, it showed an insignificant effect in low-income nations. He stated that the outcomes vary based on the countries' capacity to absorb and reap the benefits of inward FDI. The same positive and statistically insignificant results were also found by Lyroudi, Papanastasiou, and Vamvakidis (2004) for 17 transition economies from 1995 to 1998. Odhiambo (2022) examined the interaction between foreign direct investment and economic growth in Kenya during 1980-2018 using the ARDL bounds testing approach. It found unidirectional causality from economic growth to FDI in Kenya.

A negative but statistically significant and insignificant finding between FDI and growth is also reported in several studies. Alfaro, Chanda, Kalemli-Ozcan, and Sayek (2010) investigated FDI and economic growth connections using the GMM panel estimators between 1981 and 1999. The outcomes demonstrated that the inflow of FDI negatively affected nations' growth. Ahmed (2012) employed OLS regression on data from 1999 to 2008 in Malaysia, struggling to spot the result of FDI and growth in the productivity of Malaysia. The discoveries displayed that inflows of FDI adversely added to the total factor productivity (TFP) and adversely influenced economic growth. Another research by Mazenda (2014) investigated the connection between FDI and financial development from 1960 to 2002, utilizing Johansen cointegration and VECM from the viewpoint of South Africa. The outcome indicated that FDI negatively affects growth in South Africa.

Trade Openness-Economic Growth Nexus

Trade openness is estimated by calculating the summation of the volume of exports and imports, which GDP normalizes. So, how trade openness affects economic growth is the most sought question over decades. The common belief is that the degree of openness makes its economy vulnerable and open to external shocks. On the other hand, greater trade openness brings higher economic growth rates. Most of the literature on trade and growth demonstrates that trade openness rests a congenial effect on an economy's growth and income levels.

The following researchers found a positive and statistically significant association between trade openness and growth. Nguyen and Bui (2021) investigated the effect of trade openness on the economic growth of ASEAN-6 countries from 2004-2019. The authors used a fixed effects model to analyze the data and found that trade openness significantly impacts economic growth, but the effect varies with the threshold level. Arabiyat, Mdanat, and Samawi (2020) investigated the nature of inclusive growth in the case of Jordan. For that purpose, researchers used the panel data of 26 years ranging from 1990 to 2015. For the estimation, they used the GMM, FMOLS, and DOLS regression models and inferred that trade openness showed an affirmative and significant consequence on inclusive growth. However, the connection is considerably enfeebled by poverty and income inequality at the national and regional levels.

However, Sachs and Warner (1995) found a positive and statistically insignificant liaison between trade openness and growth. They utilized a cross-country sample of 122 nations and a wide assortment of data to discover the cycle of worldwide combinations and evaluate its impacts on economic growth in the improving nations. They utilized cross-country pointers of exchange openness as the proportions of every nation's direction to the world economy and presumed that transparency is insufficient to create development; stable macroeconomic strategies, underlying approaches, and establishments are also required.

Polat, Shahbaz, Rehman, and Satti (2015) studied the upshot of monetary improvement on financial development in South Africa by consolidating exchange transparency in the creative work from 1970 to 2011. They utilized the Bayer-Hanck consolidated cointegration way to deal with inspecting the quite a while ago run connection between the factors. The outcomes demonstrate

that monetary improvement animates financial development, yet exchange receptiveness hinders financial development. Specialists recommended that the administration divert exchange strategies to harvest ideal products of monetary improvement since quite a while ago run financial development. The interest side speculation is approved in South Africa.

Several studies also reported mixed findings. Such as, Carvalho et al. (2019) examined the liaison between shared exchange progression and per capita GDP for 15 Latin American nations through the monetary emergency of 2008. He individually applied the expanded gravity exchange model for the pre-emergency in 2004-2006, during-emergency in 2007-2009, and post-emergency periods in 2010-2012. For the model particulars, the study utilized Geographical physiognomies and majority rule government paces of republics as an instrument for regular two-sided exchange masses. By testing various methodologies of exchange receptiveness, he discovered grouped outcomes. For example, first and foremost, a reasonably sure association between exchange receptiveness and development is discovered while thinking about just Latin American states.

Jalles (2012) explored the affiliation among openness, provincial trade agreements, and growth in the point of view of twenty-one South and South-East Asian nations for 25 years spreading from 1980-to 2004. The scientist utilized Bayesian Model Averaging (BMA), Granger Causality tests, Generalized Method of Moments (GMM), and OLS relapse models. The outcomes demonstrated a blended input for receptiveness to development in two subsamples. Chen, Zhang, and Wang (2022) examined the impact of economic growth and trade openness on the energy intensity of 30 provinces and regions in China during 2005-2018 using a dynamic panel model. They found that energy intensity is reduced by economic growth and trade openness when control variables are considered, and the regional variability of energy intensity is insignificant between the east and west of China. Furthermore, a negative relationship between the factors is found in the wake of taking out exceptions and remembering all merchant nations.

Economic Crisis and Economic Growth

Economic recession and the financial crisis substantially adversely impact the stable economic growth of developing countries. The recession transmits primarily through import-export and financial flows such as FDI, remittances, and development assistance, forcing millions back into unemployment and poverty. Afonso and Blanco-Arana (2022) reexamined the relation between economic growth and financial development in the global financial crisis of 2007-2008 in respect of EU/OECD countries during 1990-2016. They adopted random effects and the GMM model and found that financial development had both linear and non-linear impacts on economic growth, even in crises. Tadmon and Njike Tchaptchet (2022) established a stochastic model to examine the channel through which a financial crisis affects economic growth. They showed in respect of the deterministic case that the economy might come together either to a stress-free equilibrium or a stressed balance. In the stochastic case, they figured out a value around which the level of economic growth fluctuates. Li and Zhang (2022) explored the relationship between economic growth and bank development before and after the financial crisis in 2008 during 2002-2012 with quarterly data for US states. Using a two-step system GMM and granger causality test and found that in the long run, there exists bi-directional causality. In the short run, the crisis has amended the link by changing unidirectional causality before the problem to bi-directional causality after the crisis between bank development and growth. Tadmon and Njike Tchaptchet (2022a) used a mathematical model to investigate the relationships between financial crisis spread, economic growth, and unemployment. They stated that unemployment is the prime way financial crises affect economic growth.

Methods

Based on the data availability, we have collected panel data of selected 30 Asian countries, which include Bangladesh, Bahrain, Brunei Darussalam, China, Cambodia, Hong Kong, India, Indonesia, Iran, Israel, Japan, Kazakhstan, Korea, Kyrgyzstan, Kuwait, Laos, Macao, Mongolia, Malaysia, Nepal, Pakistan, Philippines, Russia, Saudi Arabia, Singapore, Sri Lanka, Tajikistan, Thailand, Turkey, and

Vietnam over the period 1991-2017. World Development Indicators (WDI), International Monetary Fund (IMF) database, and Penn World Table (PWT) are the primary sources of data.

One of the core targets of SDG-8 refers to sustainable economic growth. We use SDG target 8.1 as our dependent variable, which is at least 7% per year of GDP growth in underdeveloped economies. Our primary variable of interest is FDI and trade openness. FDI manipulates an economy directly by increasing the capital stock and indirectly by creating spillover effects, i.e., bringing new technology, knowledge, expertise, and skills to the welcoming economy. The endogenous growth model assumes FDI to affect growth endogenously by creating increasing returns in production through positive externalities and spillover effects. So, the model for this study will be generated using the Cobb-Douglas (CD) production function. Zhang (2003) followed the endogenous model to devise and formulate his study to identify the result of FDI on economic growth by enhancing the total factor productivity (TFP). We assume that FDI affects growth both indirectly and in a straight line. For the indirect impression of FDI on economic growth, we focus on how FDI affects growth through TFP. Ghosh Roy and den Berg (2006) found that countries with greater trade openness can absorb technology that arrives with FDI. This study also considers Kotrajaras's (2013) model, which explained that human capital (HC), level of infrastructure (Infra), and trade openness (TO) also impact TFP. As per the definition of production function:

$$Y = AL^{\beta_1}K^{\beta_2} \tag{1}$$

Y is the output of the economy, which is the combination of total factor productivity (A), the labor force (L), and capital stock (K). Following Zhang (2003), Ghosh Roy and Van den Berg (2006), and Kotrajaras (2013), we can define TFP in the following way,

$$A = \alpha FDI^{\beta_4}HC^{\beta_5}Infra^{\beta_6}TO^{\beta_7} \tag{2}$$

Combining Equation (1) and (2) and considering panel data,

$$Y_{it} = \alpha {L_{it}}^{\beta_1}{K_{it}}^{\beta_2}{FDI_{it}}^{\beta_3}{HC_{it}}^{\beta_4}{Infra_{it}}^{\beta_5}{TO_{it}}^{\beta_6} \tag{3}$$

Taking logarithm in Equation (3), we get

$$lnY_{it} = \beta_0 + \beta_1 lnL_{it} + \beta_2 lnK_{it} + \beta_3 lnFDI_{it} + \beta_4 lnHC_{it} + \beta_5 lnInfra_{it} + \beta_6 lnTO_{it} + u_{it} \tag{4}$$

Based on the existing literature, such as Makki and Somwaru (2004), we later combine several macro-economic variables that have an impression on the economic growth of Asian economies, such as government consumption (GC), domestic investment (DI), inflation, a dummy for Asian financial crisis, a dummy for world recession and the interaction term of FDI with trade openness (FDITO) as these variables have an impression on the economic growth of Asian economies. Thus, after rearranging the coefficient, the equation would be

$$lnGDPgr_{it} = \beta_0 + \beta_1 lnFDI_{it} + \beta_2 lnTO_{it} + \beta_3 lnHCI_{it} + \beta_4 lnDI_{it} + \beta_5 lnLabor_{it} + \beta_6 lnInfra_{it} + \beta_7 lnGC_{it} + \beta_8 ln(FDI{\times}TO)_{it} + \beta_9 lnInflation_{it} + \beta_{10} AFC_{it} + \beta_{11} Recession_{it} + u_{it} \tag{5}$$

Lastly, we further aim to investigate the causal relationship between FDI and TO, GDP growth, and the direction of causality using the Granger causality test. Where GDPgr denotes the per capita GDP growth rate, FDI represents the inflow of foreign direct investment(% of GDP), TO is trade openness (trade expressed as a percentage of GDP), HCI is the log of the human capital index, DI is the domestic investment refers to gross fixed capital formation used as the proportion of GDP, Labor is the log of the total labor force, Infra is the infrastructure proxied by fixed telephone line subscriptions expressed as per 100 people, and GC is the government consumption as a percentage of GDP. AFC and recession are dummy variables for the Asian financial crisis and world recession which is equal to 1 for the Asian financial crisis time (1997-1998), otherwise equal to 0, and 1 for the world recession period (2008-2009), otherwise, it is equal to 0. The subscript i stands for country i in each group where i = 1, …, 30 for Asian economies, and subscript t stands for a time where t = 1991, …, 2017.

Results and Discussion

This study uses Pesaran cross-sectionally augmented dickey fuller (pescadf) test allows researchers for accounting cross-sectional dependence among the heterogeneous panel units (Pesaran, 2004). Unit root tests for dummy or categorical variables do not make sense as they try to decide whether a stationary process generated a variable. So, we do not need to test unit roots for dummy variables. We found all variables stationary at first difference.

In theory, economic growth is affected by an extensive collection of macroeconomic variables, and it is also affected by its own lagged values (previous year's growth). The dynamic panel model measures this economic growth impact by its last year. The advantage of the dynamic panel model is the control of endogeneity problems using the instrument variable. In Tabel 1, we have used the dynamic panel model to check the endogeneity problem and the robustness.

Table 1. Regression Results
Dependent variable: Economic Growth (GDPGR)

Variables	(i) PCSE	(ii) FE-robust	(iii) Difference GMM (Two-step)	(iv) System GMM (Two-step)
L.*ln*GDPgr		0.215***	0.231**	0.414**
		(0.057)	(0.090)	(0.177)
*ln*FDI	0.337***	0.249***	0.250*	0.200*
	(0.060)	(0.083)	(0.128)	(0.098)
*ln*TO	0.002	0.014	0.057**	0.022**
	(0.003)	(0.009)	(0.021)	(0.009)
AFC	-3.041**	-3.208***	-2.789***	-3.032***
	(1.195)	(0.709)	(0.725)	(0.669)
Recession	-3.182***	-3.162***	-3.220***	-3.076***
	(1.102)	(0.487)	(0.591)	(0.586)
*ln*DI	0.084***	-0.0002	0.019	0.024
	(0.028)	(0.050)	(0.041)	(0.042)
*ln*GC	-0.139***	-0.168**	-0.126	-0.068
	(0.035)	(0.077)	(0.078)	(0.053)
*ln*Infra	-0.016	0.024	0.008	-0.010
	(0.014)	(0.025)	(0.034)	(0.026)
*ln*Inflation	-0.011***	-0.009***	-0.010***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.020
*ln*Labor	0.278***	-1.137	0.048	0.153**
	(0.084)	(0.974)	(1.362)	(0.065)
*ln*HCI	0.652	-1.349	-3.926	-1.801
	(1.041)	(2.527)	(2.929)	(1.302)
*ln*FDI×*ln*TO	-0.0009***	-0.0006**	-0.0009**	-0.0009**
	(0.000)	(0.0003)	(0.000)	(0.000)
Constant	-2.062	22.72	-	-
	(1.554)	(14.63)		
Observations	725	706	676	706
Number of country	30	30	30	30
R-squared	0.285	0.274	-	-
Robust SE/Corrected SE	Yes	Yes	Yes	Yes
Groups/Instruments	-	-	30/15	30/18
AR(1) p	-	-	0.001	0.005
AR(2) p	-	-	0.416	0.725
Sargan Test (p)	-	-	0.430	0.119
Hansen Test (p)	-	-	0.470	0.398

Notes: Star signs ***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively; brackets contain standard errors under robust measures; p-values are conveyed for AR (1), AR (2), Sargan test and Hansen statistics. Estimation techniques of GMM estimator is using of xtabond2 of STATA (Roodman 2009).

In column (i), we have used the Panel Corrected Standard Errors (PCSE) to check all the problems, i.e., heteroscedasticity, cross-sectional dependence, and first-order auto-correlation problems in the short panel data model. Here, we see that FDI and TO positively affect economic growth in Asian economies, whereas AFC and Recession show significant native impact on growth. Almost all models above produced the same results for interested explanatory variables, i.e., FDI, TO, AFC, and recession, with only exceptions in some control variables.

In column (ii), the robust measure of fixed effects has been used to correct the heteroskedasticity problems. We observe closely that standard errors have increased by the robust estimation to correct them from heteroskedasticity problems. Here, we find that all four interested independent variables are significant. Foreign Direct Investment (FDI) and trade openness (TO) show coefficients of 0.299 and 0.0216, which are significant at the 0.01 level, stating that if the inflow of FDI and openness increases in Asia, the economic growth will be boosted by 0.299% and 0.0216% respectively. The dummy used for the shock of the Asian financial crisis (AFC) and recession significantly negatively impacted Asia's economic growth (GDPgr). The coefficients of -3.163 and -3.103 mean that due to the shock of financial collapse in 1997-1998 and the world recession in 2008-2009, Asian economies sharply dropped, respectively. Among control variables, domestic investment (DI) and infrastructure (Infra) positively impact growth, and other control variables, i.e., GC, HCI, labor, inflation, and interaction of FDI and TO, show a negative effect on economic growth. Inflation is negative and significant at 0.01 level with a coefficient of -0.0112 which means that if inflation goes up by 1%, it will drive economic growth down by 0.0112%. The interaction term FDI and TO shows a significant and negative influence on economic growth, and its coefficient of -0.000736 is significant at a 0.05 level.

From column (iii), we see that in the two-step difference-GMM, the lagged dependent variable (L.GDPGR) is positive and significant at 0.05 levels. Its coefficient of 0.231 states that if the previous year's economic growth changes by 1%, it will boost the current year's economic growth by 0.231%. It indicates a strong relationship between the present growth rates with the past. We observe that all of the coefficients of the lagged dependent variable are below 1, which denotes the presence of strong conditional convergence that is supported in the literature and mentioning to dynamic process stability over the methods (Fayissa & Nsiah, 2010; Petreski, 2009; Roodman, 2009).

FDI escalates the excellence of human capital in the host economy by cultivating the host country firms' methodological knowledge and management skills, thus resulting in economic growth for developing and developed nations, stated Kizilkaya et al. (2016). Here, Foreign Direct Investment (FDI) displays a positive and significant impact on economic growth. It has a coefficient of 0.250, which shows significance at the 0.10 level. It means that if the inflow of FDI increases by 1%, then economic growth will be increased by 0.250%, remaining other things the same. The same results are found in the research by Acharyya (2009) and Baharumshah and Almasaied (2009). Trade openness (TO) is positive and significant at a 0.05 level of significance which claims that trade openness in Asian economies has contributed to enhancing economic growth as the same is found earlier in the study of Arabiyat et al. (2020) and Frankel and Romer (1999). The Asian financial collapse of 1997-1998 had a substantial negative shock on Asian economies and the world. Here, we have found evidence that AFC has a negative and significant influence on economic growth. It contains a coefficient of -2.789 which means that due to the Asian financial collapse from 1997 to 1998, the Asian economic growth declined sharply. This result is justified by Thangavelu, Wei Yong, and Chongvilaivan (2009). The coefficient of recession is -3.220, which states that incongruence with the world economic recession in 2008-2009, the Asian economies also showed a downward trend in economic growth, and the value of the coefficient is statistically significant at a 0.01 level of significance. Government consumption (GC) is negative but not significant, which means if government consumption expenditure increases economic growth of a country decreases. This situation can happen when the government of any economy finances its expenditure by raising taxes on people's and corporations' incomes. Infrastructure (Infra) is positive, labour is positive, and human capital index (lnHCI) is negative, but all of these controlled variables are insignificant in explaining the variation in the dependent variable (GDPgr). As inflation hampers the normal lifestyle

of the people in any country, we have found evidence that its coefficient is negative and significant at a 0.01 level of significance. Due to a 1% increase in inflation, Asian economic growth has decreased by 0.0096%. The interaction term of foreign direct investment and trade openness (FDI×TO) is negative but significant at 0.05 with a coefficient of -0.000925.

From (iv), in the two-step system-GMM, we notice that the coefficients of all interested independent variables are significant and show the expected sign. Here, we have also found proof of the lagged dependent variable affecting economic growth, which offers a positive and considerable influence. FDI and trade openness have shown their coefficients' positive and significant value in affecting the economic development of Asian economies. Similarly, as predicted in earlier models, AFC and recession significantly negatively influence economic growth. The coefficient of control variables shows expected signs and influence on the dependent variable.

In the above table, we have displayed four different results for the economic growth model to check the robustness of the results. We observe that the static regression model results are similar to those in the dynamic panel models (difference-GMM and system-GMM). So we confirm the validity of results found in all models as the post-estimation methods prompted the accurate decision.

Estimating Long-run Impact of FDI and Trade openness on Economic Growth

This study investigates the long-run effect of FDI, trade openness, Asian financial crisis, recession, and other control variables on economic growth. In the dynamic panel model, researchers find a scope to measure the long-run coefficients of the independent variables on the explained variable. This system of approximating the long-run coefficients and the standard errors has been provided by Papke and Wooldridge (2005) in a dynamic panel data model.

Table 2 includes the long-run impact of predictor variables that were statistically significant under the system-GMM estimation. We see that the long-run coefficient of FDI is positive and statistically significant at a 5% level. The coefficient of FDI states that if the inflow of FDI increases in Asian economies by 1%, it will boost the region's economic growth by 0.038% over the long haul. Trade openness (TO) also shows a positive and significant effect on economic growth in the long run by explaining that a 1% change in openness will trigger Asian growth by 0.04%. Asian financial crisis (AFC) and recession also significantly negatively influenced economic growth in Asian economies, ultimately similar to those in the short run. As an indicator of financial instability in economic growth, inflation has negatively influenced growth studies. Here, we find the coefficient of inflation is -0.0111928, which is significant at the 0.01 level stating that if inflation increases by 1%, economic growth will decrease by 0.0112%. The long-run impact of labor is positive on economic growth, and its coefficient (0.261) is statistically significant at a 0.05 level. The interaction effect of FDI and trade openness is negative on growth in the long run, and the 0.05 level of significance validates it. Therefore, we observe that all of the significant estimates in the short run also remained significant in the long run under the system-GMM estimation.

Table 2. Long-Run Coefficients

Variables	Coefficients	Standard Errors	P>|z|
*ln*FDI	0.341	0.164	0.038**
*ln*TO	0.038	0.019	0.040**
AFC	-5.173	1.767	0.003***
Recession	-5.248	2.272	0.021**
*ln*Inflation	-0.0112	0.001	0.000***
*ln*Labor	0.261	0.115	0.023**
*ln*FDI×*ln*TO	-0.002	0.001	0.033**

N.B. ***, ** and * display the significance levels at the 1%, 5% and 10% respectively.

Granger Causality Tests

Following Dumitrescu and Hurlin (2012), we applied the Granger Causality test to estimate how FDI, GDP growth, TO, and growth influence each other. We have reported the appropriate lag structure for the test as suggested by the Akaike Information Criterion (AIC) in Table 3. The test

produces Wald statistic, Z-bar statistic, and Z-bar tilde statistic results and among these, we have presented and discussed Wald statistic and z-bar tilde statistic. Moreover, "the Z-bar tilde statistic is favoured if the number of entity (N) is large and a number of a time period (T) is small," as suggested by Dumitrescu and Hurlin (2012). The results show that FDI granger causes economic growth (GDPgr), which becomes significant at 0.05. Still, growth does not granger cause FDI as stating the existence of unidirectional causality. Government consumption (GC), labor, and human capital index have unidirectional causality to economic growth. However, trade openness (TO), domestic investment (DI), infrastructure (Infra), and inflation do not have granger causality from and to economic growth.

Table 3. Granger Causality Tests

Null Hypothesis	Wald statistic	Z-bar tilde statistic	Prob.	Conclusion
FDI does not granger cause GDPgr	22.578	2.143**	0.032	Unidirectional
GDPgr does not granger cause FDI	17.308	1.108	0.268	causality
TO does not granger cause GDPGR	12.430	0.150	0.881	No granger
GDPgr does not granger cause TO	10.938	-0.143	0.886	causality
DI does not granger cause GDPgr	19.822	1.602	0.109	No granger
GDPgr does not granger cause DI	14.612	0.578	0.563	causality
GC does not granger cause GDPgr	22.980	2.222**	0.026	Unidirectional
GDPgr does not granger cause GC	10.098	-0.308	0.758	causality
Infra does not granger cause GDPgr	14.066	0.439	0.661	No granger
GDPgr does not granger cause Infra	10.883	-0.143	0.886	causality
Inflation does not granger cause GDPgr	10.392	-0.233	0.816	No granger
GDPgr does not granger cause Inflation	10.771	-0.164	0.870	causality
Labor does not granger cause GDPgr	26.864	2.776***	0.006	Unidirectional
GDPgr does not granger cause Labor	9.554	-0.386	0.699	causality
HCI does not granger cause GDPgr	28.302	3.042***	0.002	Unidirectional
GDPgr does not granger cause HCI	10.018	-0.301	0.763	causality

N.B. 1%, 5% and 10% significance levels are represented by ***, ** and *. The lag order selection was made based on the AIC criteria.

Conclusion

This study shows that almost all regression techniques produce positive results for FDI. If FDI increases, economic growth also increases in Asian economies in the short and long run. FDI displayed unidirectional causality to economic growth, whereas trade openness showed no Granger-causality from and to the economic growth of Asian economies. Expectedly, trade openness also positively influences economic growth, which elaborates that when an economy is exposed to the outer world, its volume of trade, competition, and rivalry among the producers increase, thereby leading to higher growth. The Asian financial crisis shock and the world recession have negatively influenced Asian economic growth. From almost all techniques, Asian financial crisis and recession showed a negative and significant effect on Asian economic growth. Domestic investment, infrastructure, labor, and human capital show mixed results on economic growth based on different regression methods from all control variables. Government consumption, inflation, and the interaction effect of FDI and trade openness showed a negative outcome on economic growth in all tests.

Asian policymakers should formulate and implement policies to ease business and ensure a favorable environment for foreign investment and open trade. Asian economies need to formulate and implement shock absorptive and cautionary policies to keep the economy strong and viable to prevent regular economic activities from financial collapse. Moreover, the economic cost of a crisis can be reduced by ensuring a decent macroeconomic environment, a high level of reserve management, and a sound banking system. Asian policymakers must pay special attention to curbing the inflation rate and formulate updated policies by revisiting existing policies regarding

human capital and government consumption expenditures to achieve SDG-8 (decent work and economic growth) within the stipulated time.

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Economic Journal of Emerging Markets, 14(2) 2022, 244-258

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Economic Journal of Emerging Markets
Available at https://journal.uii.ac.id/jep

Competition and banks' financial performance in dual banking: Evidence from efficiency-adjusted market power

Mudeer Ahmed Khattak*[1], Mohsin Ali[2], Noureen A. Khan[3]

[1,3]Iqra University-Islamabad, Islamabad, Pakistan
[2]Taylor's University, Kuala Lumpur, Malaysia
*Corresponding author: mudeerkhattak@gmail.com

Article Info

Article history:
Received 7 January 2022
Accepted 13 October 2022
Published 31 October 2022

JEL Classification Code:
G21, G28, G32

Authors' emails:
mohsin.ali121@gmail.com
phdnorin@gmail.com

DOI: 10.20885/ejem.vol14.iss2.art8

Abstract

Purpose — This paper examines banking competition's effect on Malaysia's financial performance from 2008–2020. This study investigates the relationship between banks' market competition and financial performance by examining banks' profits and risks. Further, this current study examines whether the association differs for Islamic banks.

Methods — The research studies Malaysia as a sample country and employs a data span from 2008-2020. In order to address omitted variable bias, simultaneity and endogeneity are avoided using a two-step GMM model.

Findings — Our results recommend that more competition inspires the banking sector to invest in risky ventures to offset the losses in revenues. Moreover, banking today is still based on basic banking operations like granting loans (or financing in Islamic banks), collecting deposits, and managing payment systems.

Implication — Since our findings show a negative effect of competition on the bank's financial performance, we suggest that competition lowers banks' profits and results in greater risk. It is suggested that regulators and policymakers develop the financial infrastructure in terms of controlled competition in banking and encourage banks to diversify their operations efficiently. We find no significant difference in the association between conventional and Islamic banking.

Originality — This research is the first to examine the effect of bank competition on the financial performance of a developed dual banking system using the efficiency-adjusted Lerner index.

Keywords — Competition, performance, efficiency-adjusted lerner index, GMM

Introduction

Banking competition refers to extra competition that could simultaneously prompt additional innovation in the products offered, making the banking system more fragile. This competition could lead to a decline in the bank profits, and the dissolution can lead the banks to face more challenges to keep up the benefits. Looking for more dangerous speculations and policies will prompt further credit disappointments and unsteadiness. Therefore, restricted competition will lead banks to make secure venture choices and assure the establishment of a sound banking system.

The debate on the impact of competition on the performance of banks started during the 1980s but is still inconclusive. This discussion has made the financial business and the policymakers indifferent. The contentions of the analysts are threefold. The arguments are that the banking

P ISSN 2086-3128 | E ISSN 2502-180X

competition first prompts hazard taking, increasing fragility in the banking sector (Besanko & Thakor, 1993; Repullo, 2004; Soedarmono, Machrouh, & Tarazi, 2013). Second, increased competition leads to less hazard taking and competition-stability (Kick & Prieto, 2015; Matutes & Vives, 1996; Schaeck & Cihak, 2014), thirdly a reversed U-shaped nonlinear relationship (Martínez-Miera & Repullo, 2010). Despite solid evidence, all these three contentions are supported; nonetheless, despite everything, the conversation needs indisputable contentions.

Few researchers have studied the differing effect of competition on bank profitability and stability (Kabir & Worthington, 2017; Khattak, Alaeddin, & Abojeib, 2021; Naceur & Omran, 2011; Rizvi, Narayan, Sakti, & Syarifuddin, 2020; Tan, Chi, Lau, & Gozgor, 2020). These studies have employed either the traditional Lerner index or market concentration as a competition proxy. Traditional Lerner is a superior proxy compared to the competition, but it also has received some criticism. As per Khattak, et al. (2021) and Koetter, Kolari, & Spierdijk, (2012), the traditional Lerner index assumes cost and price efficiency, which is very unlikely. It is also essential to control for inefficiency as it is an important factor in the relationship between marginal cost and price, which consequently impacts the Lerner index. Hence, to address the traditional approach's problems, we employ an efficiency-adjusted Lerner index to represent market competition in this study.

Based on this current research objective, the ideal methodology is to investigate the relationship in a dual banking framework. While most studies have aimed at advanced economies, this examination investigates the association in a double financial framework, considering Malaysia as an example. Malaysia is an ideal nation to investigate the relationship in a double financial framework. Taking a glimpse at the present market structure of Malaysia, where a significant share of Islamic banks is in operation, working alongside Islamic windows and the subsidiaries of the foreign and conventional banks, it is difficult to anticipate the idea of the association. Also, Malaysia aims to raise Islamic banks' Islamic financial share in the banking sector, which will escalate market competition. Along these lines, it is essential to study the dual banking system of Malaysia in terms of the effect of banking competition on banks' profitability.

Malaysia has seen colossal development in Islamic banking in the previous scarcely eras. The development began with Bank Islam Malaysia Berhad in 1983, and the area presently contains 16 Islamic banks. Bank Islam was the leading Islamic bank until 1993 when the Malaysian government presented the 'Islamic Banking Scheme' where customary Banks could begin offering Islamic monetary administrations. This scheme expanded the competition with Islamic financial windows coming into the image. The bank Muamalat Malaysia Berhad entered the competition in 1999 after the Asian emergencies. From then forward, competition in Malaysian banking has expanded with the presentation of recently settled Islamic Banking auxiliaries. The competition seemed challenging when new banks began activities in Malaysia. From that point forward, the development of the Islamic financial part in Malaysia has been momentous. Islamic banking has been assuming a massive part in the Malaysian financial market throughout the long term. The proportion of Islamic financial resources for absolute financial resources was recorded at 21.6% in 2016 (Ernst & Young, 2016). Roused by this rapid development, Malaysia intends to accomplish a 40% Market share for Islamic banking with insufficient financial resources by 2020. This condition will additionally build market competition. On the off chance that the Malaysian financial area is following the 'competition-delicacy' contention, the expansion in Islamic financial offer probably will not bring great outcomes, and it may confront rising dangers to the money-related framework. This examination offers further research on the relationship between various bank types in a dual banking system.

Considering the above disagreements, examining this association in an established dual banking system is worth examining. This exploration utilizes board information displaying to test the legitimacy of this association. This dataset spans from 2007 to 2017. The observational outcomes appear that competition in the financial segment exposes the banks to take more risk, resulting in lower profitability. The outcomes affirm a negative association between the competition and banks' profitability. Competition can be additionally explained by the way that with an expansion in the competition (or decrease in competition), the profits of banks increase (or decrease). The banks are compelled to search for further options of investment that appear to

be more hazardous to repay the decrease in benefits or increment in misfortunes as of the passage of new rivals in the market.

Many advocates advocate the negative association between banks' profitability and competition. Keeley (1990) asserted that the expansion in competition contracts banks' charter values. A negative tradeoff between profitability and competition exists that decreases the banks' charter values and profits. The decrease in profits due to competition drives the banking sector to loosen up its screening and monitoring standards for borrowers, resulting in a decay in the overall quality, especially in credits. Marquez (2002) asserted that increased competition scatters the borrowers' information, prompting higher financing expenses and giving more advantages to inferior quality borrowers. Matutes and Vives (1996, 2000) held that increased market power decreases the likelihood of banks' default. Caminal and Matutes (2002) contended that extreme competition would loosen up the market loaning strategies, bringing additional loans, which may lead banks to participate in more dangerous activities that will increase the bank's risk and thus lower profits.

On the other hand, some findings support the positive relationship between competition and performance (Danisman & Demirel, 2018; González, Razia, Búa, & Sestayo, 2017; Khattak & Ali, 2021; Rizvi et al., 2020; Schaeck, Cihak, & Wolfe, 2009; Tan et al., 2020). Excessive market power in borrowing and lending results in increased rates for the borrowers, and more competition prompts a decrease in banks' profits. The higher competition will reduce the financing costs ansd drive the borrowers to put resources into certain activities, henceforth more secure banks. Mishkin (1999) asserts that governments compensate the concentrated business sectors that may bring moral danger and expose the banks to challenges that may make these businesses very fragile. For bank-specific market power, the Lerner Index as an intermediary is utilized by Prieto and Kick (2013), who suggested that market power decreases the chances of bank failure. However, we found that Boone Indicator reports fewer dangers of default with less market power (more competition). A more substantial level of market power is associated with increased salary unpredictability, greater bankruptcy dangers, and bank capital proportions (Clark, Radić, & Sharipova, 2018; Davis, Karim, & Noel, 2020; Khattak, Alaeddin, et al., 2021; Soedarmono et al., 2013). Noman, Gee, and Isa (2017) recently confirmed these findings and supported the competition-fragility view.

Tabak, Fazio, and Cajueiro (2012) report a nonlinear connection between competition and the conduct of danger acceptance since both high and low competition improves financial performance. They argued that normal competition experience brings more risk when contrasted with low and high competition. Investigating the Spanish financial framework, Jiménez et al. (2013) suggest that diminishing competition in the banking sector increases the risk in the banking sector. These results confirm the non-linearity and are aligned with the findings of Tabak et al. (2012). This association is in line with the findings of the MENA region studied by the González, Razia, Búa, and Sestayo (2017).

Methods

This research employs the Lerner Index to quantify competition in the banking sector and uses the ratio of return on assets as a bank's profitability indicator. We utilize the bank-level data spanning from 2007–2018 taken from the database of FitchConnect, and for the macro indicators, the Data is employed from (WDI) World Development Indicators. All the Malaysian commercial banks, including 15 Islamic and 27 conventional banks making up 42 banks, are included in this study.

Financial Performance

We employ banks' returns on assets and banks' return on equity as a bank's profitability measures. Banks' return on assets is estimated as net income divided by total assets (ROA), while Banks' return on equity is estimated as net income divided by total equity (ROE). The existing studies widely use ROA and ROE to proxy the firms' financial performance (Cho, Chung, & Young, 2019; Weber, 2017; Joo et al., 2011). It is pertinent to mention that a higher return on assets (ROA) and return on equity (ROE) imply a higher level of banks' profits. It is the number of standard

deviations that a bank's ROA has to decline lower than its predictable value before equity is exhausted and the bank does not remain solvent. This will allow us to compare conventional and Islamic bank groups. To proxy the bank's risk performance, we use Zscore. For this risk proxy, we followed existing studies (Cihak & Hesse, 2008; Demirgüç-Kunt & Detragiache, 2011; Laeven & Levine, 2009). The higher values of Z-score mean less risk and more stability. Following Khattak et al. (2021), we use a three-year rolling window to estimate the ROA standard deviation to capture the maximum sufficient variation in the Z-score. We use a natural logarithm to avoid skewness in the Z-score, Zscore is estimated as:

$$\text{Zscore}= \frac{Equity\ ratio + ROA}{SD\ of\ ROA} \tag{1}$$

Competition Measure

Primarily, the traditional Lerner index entails two issues in estimation, i.e., efficiency might drive the market structure, and since the index assumes both cost and profit efficiency, it fails to reflect the market power of institutions. Therefore, the adjusted Lerner index by Koetter et al. (2012) is adopted for this study. Adjusted Lerner stated as follows:

$$ADL = \frac{J_{it}+K_{it}-M_{it}*Q_{it}}{J_{it}+K_{it}} \tag{2}$$

In this equation, ADL is the denotation of the adjusted Lerner index. *i* signifies a bank in a year *t*; J represents the bank's profit (net income), K includes the interest and non-interest costs, making it the bank's total cost, and M represents a marginal cost. Total output is represented by Q. Following Battese and Coelli (1995), we choose the Stochastic Frontier Analysis (SFA) model over the data envelopment analysis (DEA). The reason is that the SFA bifurcates the error component into two. In contrast, the DEA assumes inefficiency as the sole reason for all the deviations, ignoring the impact of random errors. We also include equity while modeling the efficiency-adjusted Lerner Index as it reflects different characteristics of the banking business. For Cost-efficiency frontier modeling, we modify the model as:

$$\begin{aligned} lnK_{it} = {} & \partial_0 + \partial_1 lnQ_{pit} + \frac{1}{2}\partial_2 (lnQ_{it}^2) + \sum_{j=1}^{3} \delta_j\, lnZ_{jit} + \gamma_1 lnE_{it} + \\ & \frac{1}{2}\sum_{j=1}^{3}\sum_{j=1}^{3} \delta_{jk}\, lnZ_{jit}\, lnZ_{kit} + \sum_{j=1}^{3} \gamma_j lnQ_{pit} ln\, Z_j + \theta_1 T + \frac{1}{2}\theta_2 T^2 + \\ & \theta_3 T lnQ_{pit} + \sum_{j=1}^{3} \sigma_j T\, lnZ_{jit} + \varepsilon_j + \varphi_j \end{aligned} \tag{3}$$

Here, K represents total cost; Q represents output, and Z indicates different input prices i.e., price of deposits, labor price, and price of capital. T is time trend that takes care of technical change. p represents the ratio of revenue and total assets. We use two outputs, i.e., a total of securities and the total of all loans. We also assume that the error term comprises both ε_j and φ_j. ε shows the impact of random noise, whereas φ shows the inefficiency of the frontier.

This study standardizes all price factors (Z) and costs (K) which warrants the Linear homogeneity similar to the traditionally used Lerner estimations. By taking the derivative of K, M is modeled as given below:

$$M_{it} = \frac{K_{it}}{Q_{it}} (\partial_1 + \partial_2 lnQ_{pit} + \sum_{j=1}^{3} \gamma_j ln\, Z_{jit} + \theta_3 T) \tag{4}$$

Koetter et al. (2012) argue that profit inefficiencies are much more significant and important than cost inefficiencies, making it challenging to handle them significantly. Our main motive is to discover the level of banking competition concerning levels of efficiency, and having an erstwhile assumption of market competitiveness would be unrealistic. Thus, we use a substitute model of profit efficiency where we do not assume perfect competition in the banking sector. This profit efficiency model calculates the bank profitability level to its output factors. Profits before taxes (PBT) is used as another dependent variable, and the equation is as follows:

$$lnPBT_{it} = \partial_0 + \partial_1 lnQ_{pit} + \frac{1}{2}\partial_2 (lnQ_{it}^2) + \sum_{j=1}^{3} \delta_j \, lnZ_{jit} + \gamma_1 lnE_{it} + \frac{1}{2}\sum_{j=1}^{3}\sum_{j=1}^{3} \delta_{jk} \, lnZ_{jit} \, lnZ_{kit} + \sum_{j=1}^{3} \gamma_j lnQ_{pit} ln \, Z_j + \theta_1 T + \frac{1}{2}\theta_2 T^2 + \theta_3 T lnQ_{pit} + \sum_{j=1}^{3} \sigma_j T \, lnZ_{jit} + \ln NPI + \varepsilon_j + \varphi_j \quad (5)$$

We have added another variable in the equation, i.e., negative profit indicator (NPI). The purpose of adding this variable is to tackle the natural logarithm issue of possible negative values of PBT. The NPI will take a value of 1 if the PBT is positive or equal to zero. On the other hand, if the PBT value is negative, the NPI will take a value precisely equivalent to the absolute value of PBT.

Control Variabels

This study employs country and industry-specific variables to analyze and control the country and industry characteristics. Controlling Equity Ratio (ETA) suggests that banks with high capital ratios are further prone to better performance because they have a higher capacity to use equity in their business operations. Following Liu, Molyneux, and Nguyen (2012) and Čihák and Hesse (2010) suggest that banks' risk will not be affected by their size in dual banking systems because large banks may opt for more risk and operate differently as per their sizes. The log of total assets (LnTA) controls the size of the banks. Furthermore, the level of bank lending is controlled by the gross loans to total assets (GLTA). Diversification (Diversification) is also controlled, which is estimated as the ratio of non-intermediation income to total income. We restrict the control variables with the most suitable proxies to keep the specification simple and resolve issues like multicollinearity by including bank-specific variables. We also control for the market structure to control for the change in market structure change over time. The measure of market structure is the Herfindahl Hirschman Index (HHI). Some Macroeconomic variables are included using the GDP growth rate (GDP growth) and Inflation rate (inflation). The variable named "Islamic" represents the Islamic bank in this research with a dummy variable equal to one for Islamic banks and 0 for the conventional bank. Including an Islamic bank dummy in the model has enabled us to examine the impact of Islamic and conventional banks to analyze any difference. We employ the global financial crisis as a dummy variable which takes a value of 1 for 2008-09 and 0 otherwise.

Model

The impact of bank competition on profitability is studied by examining the following model:

$$lnPR_{ijt} = \partial_0 + \partial_1 lnPR_{ijt-1} + \partial_2 lnLERN_{ijt} + \partial_3 BC_{ijt} + \partial_4 MC_{jt} + \partial_5 Islamic + \varepsilon \quad (6)$$

In the model mentioned above, *i* denotes bank, *j* is the country, whereas *t* symbolizes the year. $LnPR_{jt}$ indicates profitability measure, the ROA, ROE, and lnzscore, PR_{ijt-1} represents one-period lag for the banking profitability and risk measures, our inverse estimate of competition is *efficiency-adjusted Lerner Index*, denoted by $LERN_{ijt}$. To control for the effect of bank-specific variables BS_{it} is employed. Log of total assets (lnTA) is used to capture the size of the banks, equity ratio (ETA), the ratio of gross loans (GLTA), and diversification ratio are also controlled. Finally, MC_{jt} represents a vector of the country-level variables, GDP growth, HHI, and Inflation. Also, the global financial crisis (GDP, HHI, Infl) and ε_{it} indicate the error. To differentiate the association for the Islamic banks, equation (3) is modified with an interaction term of Islamic and competition measures.

$$lnPR_{ijt} = \partial_0 + \partial_1 lnPR_{ijt-1} + \partial_2 lnLERN_{ijt} + \partial_3 BC_{ijt} + \partial_4 MC_{jt} + \partial_5 Islamic + \partial_6 Islamic * LERN + \varepsilon \quad (7)$$

We use the lagged values of the explanatory variables as the instrumental variables to estimate through the first differenced Generalized System of Moments (GMM) by Arellano and Bond (1991), also called the initial GMM technique. Besides, the proxies are modified by differentiating and adding the instrumental variables from the lagged values of the explanatory variables. It is pertinent to mention that associated error terms are from weak instruments through lagged values. This research's first difference in GMM could lead to unreliable estimation results. These studies employ the GMM of Blundell and Bond (1998) and Arellano and Bover (1995) to prevent the given

issues. The GMM framework can provide more robust and unambiguous results and thus help to explore the relationship robustly. System GMM offers slight variances, gives accuracy in estimation, and makes it more effective (Blundell & Bond, 1998).

Using the bank-level data make this current study has a high chance of heteroscedasticity. Furthermore, if the data contains smaller T and larger N, the dependent variable is complex. This estimator becomes the most relevant and suitable where the model control variables correlate with the model's error terms. The two-step GMM method improves performance while resolving endogeneity, serial correlation, and heteroscedasticity issues.

Results and Discussion

This section presents descriptive statistics. Table 1 reports the summary statistics of the variables. The ROA is reported as 0.95 for the entire sample; for conventional banks, 1.05, whereas for Islamic banks, the ROA is 0.74. Also, it is observed that the return on equity is higher for conventional banks, reflecting a lower level of profitability in Islamic banks. By looking at the risk measure, the zscore reports less stability in Islamic banks compared to Malaysia's conventional banks. The mean value of the Lerner index, which is the measure of competition, reports a value of 0.27 for the Malaysian banking sector, which is portrayed as close to perfect competition. The mean value of the competition for Islamic and Conventional banks is 0.18 and 0.32, respectively. This shows that there is higher competition among Islamic banks. It is seen that the log of total assets (LNTA) is 8.91 in the case of conventional banks and 8.61 for Islamic banks. The ETA is 10.94 for the whole set of samples, 12.72 for traditional, and 7.22 for Islamic banks, indicating that conventional banks are well capitalized. For the ratio of gross loans for conventional banks and the degree of financing of Islamic banks, it seems that they have a greater financing ratio than the conventional banks in the country. It appears that conventional banks are better diversified. The HHI has a mean of 0.09 for the country-level market structure for the sampling period.

Table 1. Summary Statistics

Variable	ROA	ROE	Zscore	LERN	lnTA	ETA	GLTA	DIV	HHI	GDP growth	Inflation
Full Sample											
Obs	359	359	358	349	359	359	359	359	359	359	359
Mean	0.95	11.0598	46.0057	0.27	8.81	10.94	0.57	0.25	0.09	4.89	2.52
SD	0.64	7.07186	28.43036	0.14	1.41	6.96	0.19	0.18	0.01	2.11	1.19
Min	-5.54	-30.09	4.809657	-0.23	5.23	2.93	0.01	-1.23	0.08	-1.51	0.58
Max	2.98	36.99	215.3327	0.80	11.77	63.28	1.26	0.89	0.11	7.42	5.44
Conventional Banks											
Obs	243	243	242	242	243	243	243	243	243	243	243
Mean	1.05	11.0279	50.31912	0.32	8.91	12.72	0.52	0.30	0.09	4.86	2.53
SD	0.71	7.556588	31.73721	0.12	1.60	7.74	0.20	0.18	0.01	2.18	1.23
Min	-5.54	-30.09	4.809657	-0.23	5.23	4.17	0.01	-1.23	0.08	-1.51	0.58
Max	2.98	36.99	215.3327	0.80	11.77	63.28	0.78	0.89	0.11	7.42	5.44
Islamic Banks											
Obs	116	116	116	107	116	116	116	116	116	116	116
Mean	0.74	0.744655	37.00699	0.18	8.61	7.22	0.65	0.14	0.09	4.97	2.51
SD	0.40	0.400585	16.65888	0.12	0.86	1.99	0.14	0.10	0.01	1.96	1.10
Min	-1.66	-1.66	9.88146	-0.18	7.19	2.93	0.24	-0.02	0.08	-1.51	0.58
Max	1.72	1.72	80.86047	0.43	10.82	15.45	1.26	0.65	0.11	7.42	5.44

Table 2 shows the correlation analysis and reports a weak correlation between the variables that rejects the existence of multicollinearity. However, the ROA is positively correlated to total assets, equity ratio, HHI, and GDP growth rate and is negatively related to GLTA, Diversification ratio, and inflations.

Figure 1 shows the evolution of the level of competition in the banking sector from 2007-2018. Given that the Lerner index implies the inverse measure for the market competition, Figure

1 uses the values concluded after subtracting market power from 1 to get the level of market competition. The figure clearly shows banks' market competition change throughout the sampling period. The overall trend in the level of competition for Islamic banks remains steady and is upward. However, it is worth mentioning that during the financial crises of 2007-2009, the level of competition increased. In the case of conventional banks, the competition increased during the said period because banks were struggling to survive. Right after 2008, a decline in the competition among conventional banks was observed, probably due to customers' preferences for Islamic banks as an alternative. The further decline led to increased competition in Islamic banks (Perry & Rehman, 2011). During the crisis, Islamic banks did not encounter significant losses because of the prohibition of speculative activities and the inclusion of non-interest instruments (Alam, Hamid, & Tan, 2019). Finally, due to the financial crises, the competitive pressures in the industry increased, and competition among Islamic banks has risen.

Table 2. Correlation Analysis

	ROA	ROE	Zscore	LERN	lnTA	ETA	GLTA	DIV	HHI	GDP growth	inflation
ROA	1										
ROE	0.704***	1									
Zscore	0.229***	0.269***	1								
LERN	0.566***	0.471***	0.264***	1							
lnTA	0.114***	0.269***	0.177***	0.380***	1						
ETA	0.300***	-0.183***	0.0606**	0.175***	-0.318***	1					
GLTA	-0.0966***	0.107***	0.0126	0.0869***	0.181***	-0.383***	1				
DIV	-0.0188	-0.132***	-0.263***	-0.0809***	-0.0513*	0.137***	-0.250***	1			
HHI	0.101***	0.0377	0.0483*	0.308***	0.146***	0.0898***	-0.0697**	0.0205	1		
GDP growth	0.0665**	0.0887***	0.0259	-0.0800***	-0.0888***	-0.0346	0.0643**	-0.0243	-0.218***	1	
inflation	-0.0187	0.0218	-0.201***	-0.271***	-0.277***	-0.0146	0.0184	0.0138	-0.179***	0.0945***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

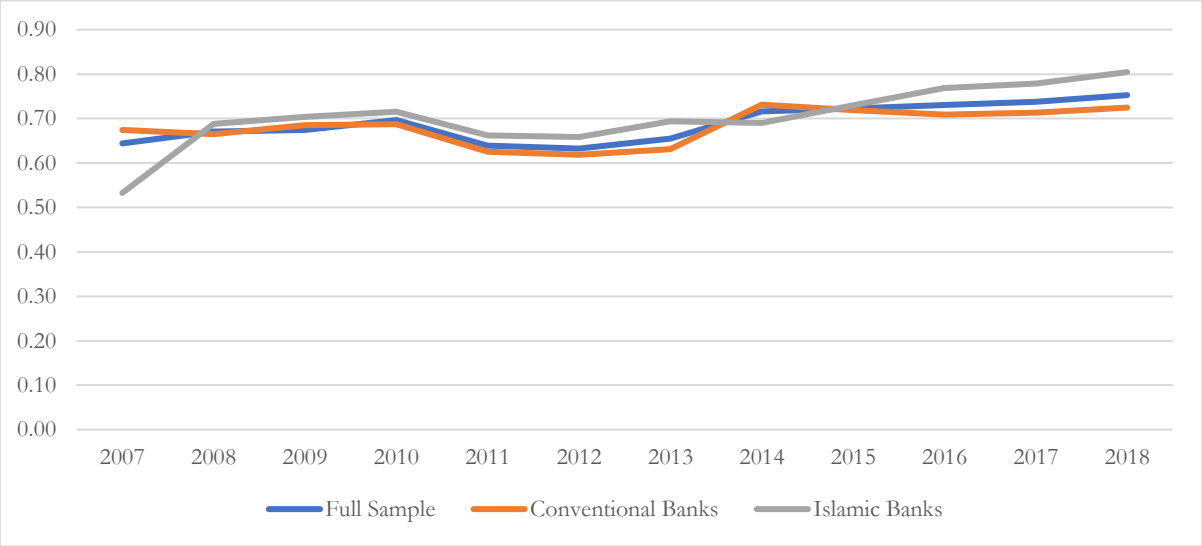

Figure 1. Competition in the Banking sector

This study employs the GMM technique in two stages of the method. The insignificant estimates for AR (1) and AR (2) signify the presence of a serial association, and the validity of instruments is validated by the trial of insignificant values of Hansen, suggesting the legitimacy of constraints of over-identification. Hansen values show that uncorrelated instruments are used in the analysis. Heteroscedasticity and endogeneity problems have been observed in the analysis, making it a suitable model.

Table 3 presents the impact of competition on banks' financial performance. Equation 6 estimates ROA, ROE, and score as the dependent variable. The regression results show that

competition, bank size (LNTA), equity ratio, loan ratio (GLTA), and inflation, describes a significant variation in banks' profitability. The findings appear consistent, and a significant positive association between the Lerner Index and the banks' profits (ROA and ROE) is found. By interpreting inversely, the results show strong evidence that competition negatively impacts banks' profits. For banks' risk measures, the findings also suggest that greater market power improves banks' stability, and increased bank competition deteriorates banks' stability. The findings are aligned with the "competition-fragility" viewpoint and verify the findings of Dima, Dincă, and Spulbăr (2014), Kabir and Worthington (2017), and Turk Ariss (2010). The research suggests that the increase in bank competition instigates higher risk-taking and investment in riskier portfolios to offset declining returns and margins and maintain market power. The signs and relationships are consistent for control variables in most regressions with various control variables combinations.

Table 3. Impact of Competition on bank's financial performance

	(1) ROA	(2) ROE	(3) Zscore
L.ROA	0.0533*		
	(0.097)		
Lerner	2.8022***	23.2216***	0.0912**
	(0.000)	(0.000)	(0.023)
lnTA	0.0748**	1.2001***	0.0415***
	(0.030)	(0.009)	(0.000)
ETA	0.0019	-0.2515***	0.0160***
	(0.704)	(0.000)	(0.000)
GLTA	0.1982**	2.6469**	0.2153***
	(0.043)	(0.029)	(0.000)
Divers	0.1518	1.4643	0.1584***
	(0.237)	(0.241)	(0.002)
HHI	-10.2197	-34.1956	-1.9957**
	(0.108)	(0.469)	(0.036)
GDP growth	0.0335*	0.4133**	0.0073
	(0.087)	(0.015)	(0.104)
Inflation	0.0467***	0.3830***	0.0078
	(0.000)	(0.008)	(0.122)
Islamic	0.1396**	2.5956***	0.0337
	(0.044)	(0.002)	(0.194)
Crisis	0.2467	2.5697*	0.0917**
	(0.160)	(0.056)	(0.016)
L.ROE		0.0925**	
		(0.017)	
L.lnzscore			0.8596***
			(0.000)
Constant	-0.1790	-8.0818	-0.0888
	(0.735)	(0.189)	(0.560)
Observations	311	311	311
instruments	27.0000	27.0000	33.0000
groups	38.0000	38.0000	38.0000
Arellano-Bond: AR(1)	0.2602	0.0836	0.0043
Arellano-Bond: AR(2)	0.1587	0.1313	0.2655
Sargan Test (p-Val)	0.6158	0.0010	0.0004
Hansen Test (p-Val)	0.2337	0.1519	0.1319

P-values are in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The most critical and relevant control variables is total assets. The total assets (LNTA) have a significant positive association indicating more risk-taking by the large banks that is not easy to manage; therefore, they invest in riskier investments. This claim is endorsed by Mishkin's "too big

to fail" statement, where they do not instantly fail even if more risks are taken. GLTA is found positive and significant in all regressions, implying that a fraction of bank risk is also disturbed by the loan growth. The Islamic dummy has a positive value, implying greater profitability for Islamic banks than the conventional counterparts.

Moreover, the HHI is only significant in model (3) with a negative coefficient. This value suggests that severe concentration in the market lowers the bank's stability. Income diversification is positively significant, which suggests that diversification enhances banks' stability and lowers banks' risk. The crisis is positive, suggesting that the Malaysian banking sector benefitted during the financial crisis. This might be because investments from other economies were moved to relatively lower-risk economies, which led to increased profitability and lower banks risk.

Table 4. Impact of competition on banks' financial performance (Islamic vs Conventional)

	(1) ROA	(2) ROE	(3) Zscore
L.ROA	0.0537*		
	(0.100)		
Lerner	2.9326***	22.8655***	0.1318**
	(0.000)	(0.000)	(0.014)
lnTA	0.0765**	1.2289***	0.0402***
	(0.029)	(0.008)	(0.000)
ETA	0.0023	-0.2430***	0.0156***
	(0.662)	(0.001)	(0.000)
GLTA	0.1719*	2.6247**	0.1941***
	(0.059)	(0.030)	(0.000)
Divers	0.1626	1.5811	0.1607***
	(0.169)	(0.212)	(0.001)
HHI	-10.9406**	-45.7743	-1.7438*
	(0.042)	(0.354)	(0.071)
GDP growth	0.0428**	0.4260**	0.0064
	(0.018)	(0.012)	(0.176)
inflation	0.0351***	0.4031***	0.0086
	(0.000)	(0.006)	(0.109)
Islamic	0.3091***	2.2082*	0.0798**
	(0.001)	(0.077)	(0.036)
Islamic # Lerner	-0.7458*	2.5318	-0.1759
	(0.051)	(0.656)	(0.134)
Crisis	0.3299**	2.7436**	0.0831**
	(0.043)	(0.046)	(0.040)
L.ROE		0.0950***	
		(0.007)	
L.lnzscore			0.8669***
			(0.000)
Constant	-0.2003	-7.5464	-0.1208
	(0.693)	(0.225)	(0.394)
Observations	311	311	311
instruments	28.0000	28.0000	34.0000
groups	38.0000	38.0000	38.0000
Arellano-Bond: AR(1)	0.2478	0.0806	0.0043
Arellano-Bond: AR(2)	0.1840	0.1309	0.2745
Sargan Test (p-Val)	0.5227	0.0011	0.0004
Hansen Test (p-Val)	0.2121	0.1616	0.1311

P-values are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4 reports the possible difference in the effect of competition on banks' profits in Islamic banks. To investigate any possible impacts of bank type (whether Conventional or Islamic)

on the association, we use equation 7, where dummy interaction for Islamic banks is added in regression. The interaction term is only significant for ROA, which shows that the increased market power leads to lower return on assets, suggesting that competition might benefit Islamic banks to grow. This finding is inline with the competition-stability point of view (Boyd & De Nicolo, 2005; Kick & Prieto, 2015; Schaeck & Martin Čihák, 2007). The insignificant interaction term shows that the impact of Islamic banks is not different from conventional banks. It appears that competition is negatively impacting the profitability of Islamic banks as well. Hence, we suggest that competition lower banks' profits regardless of bank type.

Robustness Checks

In order to support further findings, the models are reestimated using difference GMM, and the findings are explained in Appendix A1 and A2 for sections 4.2 and 4.3, respectively. Once again, the diagnostics confirm that the estimated model is valid and out of serial-auto correlation issues and that the instruments are valid. The main results are in line with the earlier discoveries, which suggest that competition in the banking sector enhances a bank's financial performance in terms of profitability and stability. Furthermore, the results of the difference in the effect of competition for the Islamic banks are robust, too, suggesting that Islamic banks might face a different relationship than conventional banks supporting the competition-stability view. The results of robustness checks are given in Appendix A. This current research also perform robustness checks with the traditional Lerner index and give results that remain unchanged and are available upon request.

The general discovery from this research is that banks face extra risk exposure when an increase in banking rivalry is found in the market. Besides, Islamic Banks might face a different relationship than conventional banks in terms of return on assets. Since no change is found in the impact of competition on return on equity and Z-score, Islamic banks might follow traditional banking operations that have diminished the distinction between Islamic and Conventional Banks. A few advocates of Islamic banking that the main essence and the Islamic banking is the feature of Profit and Loss sharing; nonetheless, it is practically not found. It is believed that they invest in profit and loss-sharing instruments, and currently, banks offer most debt-based instruments. That is the prime concern with the Islamic banking sector and exposes them to conventional partners. Chong and Liu (2009) argue that Islamic banking offers little benefit with loss sharing that creates similarity of the Islamic banks to conventional banking rates and henceforth are not liberated from the premium. The Islamic financing methods are value put together and based on benefit and misfortune sharing, as Mudarabah and Musharakah make little commitment to the Islamic bank's speculation portfolios (Chong & Liu, 2009; Ibrahim & Rizvi, 2017; Khan, 2010).

Conclusion

This research explores the association between market competition and financial performance by looking into profits incurred and risks faced by the banks. The research uses Malaysia as a sample country and the data from 2007-2018. The reason for considering Malaysia specifically is that it has an established dual banking market. This research is expected to conclude deeper insights into the relationship in the dual banking system. The issues like omitted variable bias, simultaneity, and endogeneity are avoided using a two-step system GMM model. Using an efficiency-adjusted market power, this research shows that competition lowers the profits of the banks and exposes them to more risks, supporting the competition-fragility view.

While conducting this research, it was observed that conventional banks have a greater profitability ratio than Islamic banks. Furthermore, to better understand this association between conventional and Islamic banks, a dummy is included in the analysis to reflect Islamic Bank interaction. It is reported insignificant, implying no possible major difference in the association of different bank types, whether Islamic or conventional. The results support the "competition-fragility" viewpoint irrespective of the bank type. In the case of competition, currently, Islamic banks are more competitive than their conventional counterpart.

Overall, the results support that more competition promotes the banking sector to invest in risky ventures and compensate for the revenue losses, thereby declining profitability. This finding further reveals that banking these days still rely on basic banking operations like granting loans (or financing in Islamic banks), collecting deposits, and managing the payment systems. It is advised that regulators and policymakers improve the financial infrastructure in terms of controlled competition in banking sectors and influence banks to diversify their operations efficiently.

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Appendix

Table A1. Robustness check: Impact of Competition on financial performance

	(1) ROA	(2) ROE	(3) Zscore
L.ROA	0.0474		
	(0.381)		
Lerner	2.4768***	35.6657***	0.2172***
	(0.000)	(0.000)	(0.000)
lnTA	0.0188	0.2111	-0.0045
	(0.846)	(0.853)	(0.874)
ETA	0.0167	-0.0611	0.0527***
	(0.101)	(0.407)	(0.000)
GLTA	0.3573**	1.2087	0.1806*
	(0.017)	(0.673)	(0.085)
Divers	0.2794	-3.7976	0.0438
	(0.171)	(0.271)	(0.398)
HHI	-13.1967***	-145.5794**	-2.4830**
	(0.001)	(0.033)	(0.039)
GDP growth	0.0597***	0.5785**	0.0055
	(0.000)	(0.011)	(0.215)
inflation	0.0299**	0.4914**	0.0067
	(0.022)	(0.022)	(0.188)
Crisis	0.4576***	3.7934**	0.0297
	(0.002)	(0.011)	(0.425)
L.ROE		0.1321**	
		(0.022)	
L.lnzscore			0.1558
			(0.101)
Observations	273	273	273
instruments	23.0000	23.0000	22.0000
groups	38.0000	38.0000	38.0000
Arellano-Bond: AR(1)	0.2460	0.0774	0.2985
Arellano-Bond: AR(2)	0.3066	0.5971	0.8462
Sargan Test (p-Val)	0.3841	0.0004	0.0120
Hansen Test (p-Val)	0.0991	0.0906	0.1205

P-values are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2. Robustness check: Impact of competition on banks financial performance (Islamic vs Conventional)

	(1) ROA	(2) ROE	(3) Zscore
L.ROA	-0.2467		
	(0.325)		
Lerner	2.5351***	29.8288***	0.1550**
	(0.000)	(0.000)	(0.029)
lnTA	0.1697	1.1394	0.0029
	(0.221)	(0.288)	(0.915)
ETA	0.0088	-0.0539	0.0531***
	(0.593)	(0.376)	(0.000)
GLTA	0.3210	2.6548	0.2066**
	(0.180)	(0.242)	(0.042)
Divers	0.1212	-2.2420	0.0693
	(0.651)	(0.467)	(0.250)
HHI	0.6937	-64.6009	-2.6144**
	(0.926)	(0.203)	(0.032)
GDP growth	0.0367	0.5491***	0.0065
	(0.232)	(0.006)	(0.154)
inflation	0.0126	0.2861	0.0061
	(0.561)	(0.186)	(0.222)
Islamic # Lerner	-0.9595*	-9.1684	0.1451
	(0.074)	(0.250)	(0.290)
Crisis	0.3804	3.8396***	0.0404
	(0.100)	(0.006)	(0.303)
L.ROE		0.1718***	
		(0.006)	
L.lnzscore			0.1590*
			(0.093)
Observations	273	273	273
instruments	15.0000	24.0000	23.0000
groups	38.0000	38.0000	38.0000
Arellano-Bond: AR(1)	0.6389	0.0601	0.2903
Arellano-Bond: AR(2)	0.1809	0.5389	0.8504
Sargan Test (p-Val)	0.2670	0.0001	0.0107
Hansen Test (p-Val)	0.1386	0.1000	0.1377

P-values are in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Economic Journal of Emerging Markets, 14(2) 2022, 259-270

EJEM
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Economic Journal of Emerging Markets
Available at https://journal.uii.ac.id/jep

Foreign direct investment and economic complexity in emerging economies

Tolulope T. Osinubi[1], Folorunsho M. Ajide[2*]

[1]Department of Economics, Obafemi Awolowo University, Ile-Ife, Nigeria
[2]Department of Economics, University of Ilorin, Ilorin, Nigeria
*Corresponding author's email: ajide2010@gmail.com

Article Info

Article history:
Received 23 June 2022
Accepted 28 October 2022
Published 31 October 2022

JEL Classification Code:
F23, O10, O47

Author's email:
tosinubi@oauife.edu.ng

DOI: 10.20885/ejem.vol14.iss2.art9

Abstract

Purpose — In this study, we investigate the impact of foreign direct investment (FDI) on economic complexity in MINT and BRICS countries.

Methodology — Data on economic complexity from MIT's Observatory of Economic Complexity and data on FDI and other determinants of economic complexity are sourced from World Development indicators which spanned between 1991 and 2020. The countries are divided into three categories: All countries pooled together, MINT and BRICS countries. We employ panel co-integrating regression.

Findings — Findings based on panel co-integration regression show that foreign direct investment positively impacts economic complexity in all the countries and MINT countries, while its impact is negative in BRICS countries.

Originality — This study adds value to the literature by scrutinizing the nexus between FDI and economic complexity in the context of emerging economies and employs the panel co-integration technique for robust analysis. The study's findings shed light on the need for governments in developing countries to implement appropriate policies encouraging FDI inflows into their respective countries. Contributing to the host country's economic complexity, FDI inflows should be focused on highly technical investment and, most importantly, should be selective to enhance the development of priority sectors. An investment promotion policy may be required to encourage foreign investment in the host country.

Keywords — FDI, economic complexity, MINT countries, BRICS countries, panel dynamic OLS.

Introduction

Recent literature underlines the beneficial impacts of economic complexity concerning entrepreneurship (Ajide, 2022), remittances (Saadi, 2020), finance (Nguyen, Schinckus, & Su, 2020), and other economic variables (Gao & Zhou, 2018; Lapatinas, 2019; Zhu & Li, 2017). However, one area that has received little attention is the impact of foreign direct investment (FDI) on economic complexity. Except for the study of Antonietti and Franco (2021), Gómez-Zaldívar, Llamosas, and Gómez Zaldívar (2021), and Khan, Khan, and Khan (2020) that examine the causality between the two variables, little is known about the nexus between FDI and economic complexity in emerging economies. This paper fills this lacuna found in the literature. This study aims to examine the impact of FDI on economic complexity in emerging economies.

P ISSN 2086-3128 | E ISSN 2502-180X

Economic complexity has to do with the production structure and capability of the economic system. It reflects the nature of knowledge accumulation by economic agents exercise in the process of production (Ajide, 2022; Nguyen, Nguyen, Duy Tung, & Su, 2021). It uses domestic knowledge to convert inputs to outputs, including products diversifying for country's exportation. The recent study of Antonietti and Franco (2021) posits that one channel for improving the economy's complexity is through foreign direct investment (FDI). Theoretically, this idea relates to the view of Romer (1993), as explained in the endogenous growth model. The author emphasizes that foreign direct investment represents the channel by which new ideas and products are introduced into the domestic economy that lacks the technical know-how of the productive knowledge in the economy.

The presence of multinational entrepreneurs in the economy may bring economic prosperity and expansion and improve the economic production capabilities to upgrade the processes and introduction of new ideas while the products' sophistication is enhanced (Antonietti & Franco, 2021; Nguyen & Su, 2021). FDI may improve the economic complexity via knowledge spillovers in the interaction between multinational and domestic companies via technology transfer from the foreign subsidiaries operating in the host country. Further enhances efficient operations, imitation of ideas, or generation of new ideas (Anand, Mishra, & Spatafora, 2012; Arnold & Javorcik, 2009). On the other hand, FDI may negatively impact economic complexity by enhancing greater competitive exposure to local firms, especially infant firms.

Furthermore, greater exposure to the competition may throw out or reduce the activities of foreign firms in the host countries in the presence of higher transaction costs, including wages and other operating costs. These actions may reduce the sophistication of the host economy and its export diversifications (De Backer & Sleuwaegen, 2003; Kosová, 2010). On empirical notes, few studies have examined the impact of FDI on economic complexity. For instance, Antonietti and Franco (2021) show causality moving from FDI to economic complexity. This is against the study of Khan et al. (2020), who document a bidirectional causality between FDI and economic complexity. Gómez-Zaldívar et al. (2021) reveal that an economy with higher sophistication attracts FDI in Mexican states. Nguéda and Kelly (2022) show that economic complexity is affected by FDI positively. Our study complements this budding literature by investigating the impact of FDI on economic complexity in emerging economies.

The contributions of this paper are as follows. To the best of the authors' knowledge, it is the first study to examine the impact of FDI on economic complexity in the group of emerging economies: Mexico, Indonesia, Nigeria, Turkey (MINT countries), Brazil, Russia, India, China, and South Africa (BRICS countries) between 1991 and 2020. According to O'neill (2001), the countries are chosen based on the claim that they have rising economies. The MINT countries are considered the most potent emerging markets in the world since it is anticipated that they will experience rapid economic expansion over the following decades, luring both domestic and foreign investors in search of investment possibilities. Similarly, the BRICS countries are expected to become dominant suppliers of raw materials, manufactured goods, and services by the year 2050, according to O'neill (2001) in Pradhan, Sachan, Sahu, and Mohindra (2022). According to Klafke, Lievore, Picinin, de Francisco, and Pilatti (2016), these countries have attained stable social and economic indices. They have historical records of comprehensive knowledge management and employ innovative strategies to boost the production of innovative products and services. These countries are recognized for their potential in the global market. For instance, India is a great exporter of technological workforce. In South America, Brazil stands out as a grain exporter, while China is a great country in the global market (Rubbo, Picinin, & Pilatti, 2021).

Furthermore, Russia stands out in the energy market, while South Africa has the best product sophistication in sub-Saharan Africa (Ajide, 2022). In addition, the study employs a panel dynamic co-integrating technique. This technique accounts for endogeneity, is robust to multicollinearity and autocorrelation, and produces efficient estimates. This panel data technique has not been previously employed in the study of the FDI and economic complexity nexus. The rest of the paper is organized as follows. Section two discusses the methodology used, including the data, descriptive statistics, and correlation analysis, together with the model specification and

analysis method. Section three provides empirical results, while section four concludes the paper and provides the policy implications.

Methods

Data

Based on a panel data analysis, the study analyzes annual secondary data on nine emerging economies: Mexico, Indonesia, Nigeria, Turkey (MINT countries), Brazil, Russia, India, China, and South Africa (BRICS countries) between 1991 and 2020. The data used include economic complexity, foreign direct investment, economic growth, capital, mobile cellular subscriptions, human capital, and trade openness. Except for economic complexity, which is accessible from MIT's Observatory of Economic Complexity (http://atlas.media.mit.edu), all of the data on the variables used were sourced from the World Bank's World Development Indicators Database's online edition. The variables are employed in their level form. Table 1 provides a summary of the variable descriptions.

Table 1. Variables Descriptions

Variable	Symbol	Measurement	Source
Economic Complexity	COM	Economic Complexity Index	MIT's Observatory of Economic Complexity (http://atlas.media.mit.edu)
Foreign Direct Investment	FDI	Foreign direct investment, net inflows (% of GDP)	WDI Database
Economic Growth	GDP	GDP per capita (constant 2015 US$)	
Capital	GCF	Gross capital formation (% of GDP)	
Mobile Cellular Subscriptions	MOB	Mobile cellular subscriptions (per 100 people)	
Human Capital	SSE	School enrollment, secondary (% gross)	
Trade Openness	TOP	Trade (% of GDP)	

Note: WDI represents World Development Indicators. Source: authors' compilation

Model Specification and Method of Analysis

In line with Lapatinas (2019), Nguyen et al. (2020), and Nguyen and Su (2021a, 2021b), the study adopts their model to capture the effect of FDI on economic complexity in MINT and BRICS countries as stated in the equation below. The study contributes by looking into factors that can influence economic complexity in MINT and BRICS countries.

$$COM_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 GDP_{it} + \beta_3 CAP_{it} + \beta_4 MOB_{it} + \beta_5 SSE_{it} + \beta_6 TOP_{it} + \pi_t + \mu_i + \mathcal{E}_{it} \quad (1)$$

Where *COM, FDI, GDP, CAP, MOB, SSE, and TOP* represent economic complexity, foreign direct investment, economic growth, capital investment, mobile cellular subscriptions, human capital, and trade openness, respectively. *"i" and "t"* denote the number of countries involved and study period. π_t is the unobserved period-specific effect, while μ_i indicates the unobserved country-specific effect. The term, $\mathcal{E}_{it}$ is the disturbance term.

Additional factors might have an impact on economic complexity as informed by theories and earlier empirical studies, such as economic growth, capital investment, mobile cellular subscriptions, human capital, and trade openness are among the control variables. One of the key factors influencing economic complexity is economic growth, as noted by Gala, Camargo, Magacho, and Rocha (2018), Hartmann, Guevara, Jara-Figueroa, Aristarán, and Hidalgo (2017), Ivanova, Strand, Kushnir, and Leydesdorff (2017), Khan et al. (2020), Lapatinas (2019), Nguyen et al. (2020), Nguyen and Su (2021a, 2021b), Saadi (2020). Economic growth is anticipated to

contribute favorably to economic complexity since GDP per capita might affect product quality. As expected, capital investment will positively affect economic complexity and, as measured by Gross capital formation (% of GDP), is employed by Nguyen and Su (2021).

The model includes a variable for mobile cellular subscriptions, which is comparable to how Lapatinas (2019) and Nguyen and Su (2021a, 2021b) use internet usage. If phone subscribers truly use their mobile phones to acquire the skills and knowledge required to improve economic complexity, then we expect a positive relationship between mobile cellular subscriptions and economic complexity. Economic complexity is proven to be highly correlated with human capital, regardless of how it is measured (Anand et al., 2012; Cabral & Veiga, 2010; Chu, 2020; Costinot, 2009; Gao & Zhou, 2018; Hausmann, Hidalgo, & Bustos, 2014; Lapatinas, 2019; Lin & Wang, 2008; Nguyen et al., 2020; Saadi, 2020; Zhu & Li, 2017). This is predicated on the idea that education boosts people's productivity, knowledge, creativity, and skills, which are relevant for an improved economic complexity. Additionally, according to Khan et al. (2020), endogenous growth theory strongly emphasizes the role that human capital plays in transforming resources and enhancing productive capabilities.

Trade openness, as argued by some studies (such as Gala et al., 2018; Gao & Zhou, 2018; Ghebrihiwet, 2019; Nguyen et al., 2020; Nguyen & Su, 2021a; Saadi, 2020; Teixeira & Fortuna, 2010), promotes technological advancement, and thus, we expect a positive relationship between trade openness and economic complexity. In other words, Keller (2010) concurs that openness will allow a nation to benefit from the diffusion of technology, which has the potential to increase economic complexity. In the same vein, Khan et al. (2020) reveal that openness enables firms to be more efficient in allocating scarce resources, thereby increasing their revenues. The increase in revenue due to trade openness, according to Bustos (2011), can make firms upgrade technology and production.

Given that there could be a co-integration among the variables in equation 1, this study uses a dynamic ordinary least square (DOLS) estimation technique to achieve its goals. This method is, thus, preferred to the other estimation techniques in that it includes the contemporaneous values, leads, and lag values of the independent variables in its first difference form to solve the issues of endogeneity and serial correlation (Kumar, Nayak, & Pradhan, 2020; Pradhan et al., 2022). Endogeneity may occur due to a reversed causality between FDI and economic complexity (Khan et al., 2020; Sadeghi, Shahrestani, Kiani, & Torabi, 2020). Therefore, the use of DOLS is appropriate for solving the potential issue.

Results and Discussion

Descriptive Statistics and Correlation Analysis

The descriptive and correlation statistics for the variables used, as shown in Tables 2 and 3, respectively, are discussed in this subsection. The mean, standard deviation, minimum and maximum values are highlighted in Table 3. The average economic complexity index (ECI)for the MINT countries is -0.268, while the average value for the BRICS countries is 0.332. Compared to the MINT countries, the BRICS countries are increasingly moving away from agriculture and pollution-intensive production toward sophisticated knowledge-based economies. This is because Nigeria and Indonesia, which are part of the MINT countries, are placed lower in the ECI, with negative values throughout the study period. This implies that most of the two countries' exports are not technologically sophisticated but agricultural and pollution-intensive products. All the countries involved show a positive average value of 0.0741, which is lower than that of the BRICS countries. The negative average value recorded in the MINT countries provides this rationale. The minimum and maximum values of ECI in MINT countries are -2.764 and 1.160, respectively, observed in Nigeria in 2009 and Mexico in 2016. In BRICS countries, South Africa in 1991and China in 2012 record the minimum and maximum values of -0.168 and 1.007, respectively. These results can be explained, in that Nigeria and South Africa are the only African countries among the selected countries with fewer exports of technologically advanced products, while Mexico sharing a border with America, has improved her exports based on technologically sophisticated products,

and China is known for producing and exporting technologically advanced products. Given all the countries under the study period, Mexico has the highest ECI, while Nigeria records the lowest ECI, both MINT countries.

Table 2. Descriptive statistics

	All Countries						
	COM	FDI	GDP	GCF	MOB	SSE	TOP
Mean	.0741	1.894	5297.268	26.334	54.092	74.726	44.553
Std. Dev.	.831	1.362	3131.737	8.402	52.049	23.597	14.524
Min.	-2.764	-2.757	527.515	12.745	.00020	23.551	15.635
Max.	1.160	6.186	12038.6	48.405	165.661	109.994	110.577
	MINT Countries						
	COM	FDI	GDP	GCF	MOB	SSE	TOP
Mean	-0.268	1.681	5364.111	26.456	49.782	66.131	48.702
Std. Dev.	1.116	1.200	3381.416	24.511	45.336	24.511	13.143
Min.	-2.764	-2.757	1414.1	23.551	0.008	23.551	20.722
Max.	1.160	5.790	12038.6	105.992	164.441	105.992	96.186
	BRICS Countries						
	COM	FDI	GDP	GCF	MOB	SSE	TOP
Mean	0.332	2.065	5242.794	26.236	57.539	82.719	41.234
Std. Dev.	0.242	1.462	2927.174	9.725	56.767	20.249	14.762
Min.	-0.168	0.002	527.515	12.745	0.0020	38.984	15.635
Max.	1.007	6.186	10370.4	46.660	165.661	109.994	110.577

Source: Authors' Computations

Table 3. Pairwise correlation

	All Countries						
	COM	FDI	GDP	GCF	MOB	SSE	TOP
COM	1.000						
FDI	0.178	1.000					
GDP	0.565	0.174	1.000				
GCF	-0.097	0.241	-0.316	1.000			
MOB	0.133	0.148	0.475	-0.048	1.000		
SSE	0.697	0.150	0.756	-0.333	0.524	1.000	
TOP	0.192	-0.044	0.197	0.051	0.154	0.190	1.000
	MINT Countries						
	COM	FDI	GDP	GCF	MOB	SSE	TOP
COM	1.000						
FDI	0.148	1.000					
GDP	0.771	0.269	1.000				
GCF	-0.286	0.158	-0.289	1.000			
MOB	0.125	0.205	0.280	0.130	1.000		
SSE	0.794	0.194	0.797	-0.210	0.576	1.000	
TOP	0.537	0.048	0.362	-0.121	0.062	0.505	1.000
	BRICS Countries						
	COM	FDI	GDP	GCF	MOB	SSE	TOP
COM	1.000						
FDI	0.324	1.000					
GDP	0.430	0.114	1.000				
GCF	0.122	0.286	-0.351	1.000			
MOB	0.192	0.103	0.637	-0.121	1.000		
SSE	0.426	0.006	0.851	-0.545	0.509	1.000	
TOP	-0.028	-0.042	0.066	0.130	0.246	0.104	1.000

Source: Authors' Computations

Similarly, the mean value of FDI in the BRICS countries is higher than in the MINT countries. In particular, the mean value of FDI as a percentage of GDP in BRICS countries is 2.065, while it is 1.681 in MINT countries. This can also explain the average values of ECI obtained in both categories of countries. The overall mean value of FDI is 1.894 as a percentage of GDP. In MINT countries, Indonesia in 2000 and Nigeria in 1994 have the minimum and maximum values of FDI as -2.757 and 5.790 as a percentage of GDP, respectively. South Africa in 1992 and China in 1993 recorded 0.002 and 6.186, respectively, as the minimum and maximum values of FDI as a percentage of GDP. This implies that Indonesia and China have the lowest and highest FDI as a percentage of GDP, considering all the countries' panels.

In sum, the mean values of all the variables falling between the minimum and maximum values indicate that all the variables are consistent. In contrast, the level of volatility of all the variables, as measured by the standard deviation values, reveals that all values of the variables employed do not deviate significantly from their mean values.

Table 3 shows the pairwise correlation among the variables. Except for capital investment in the whole sample and MINT countries and trade openness in BRICS countries, which show a negative association with economic complexity, the results from the table reveal that all the independent variables are positively associated with economic complexity. Also, it is proven that there is no indication of multicollinearity among the independent variables as all the correlation coefficients are within the tolerance rate.

Panel Unit Root and Co-integration Tests

This study employs the Fisher-type-unit root test based on Augmented Dickey-Fuller (ADF) test and Im-Pesaran-Shin (IPS) unit root test to check the stationarity properties of the variables. The results of the two tests indicate that all the variables are stationary at the first difference and that none of the variables are stationary at levels. The panel unit root tests are presented in Table 4.

Table 4. Panel Unit root tests

	Fisher-type unit-root test based on ADF test			Im-Pesaran-Shin unit-root test		
Variables	All Countries	MINT	BRICS	All Countries	MINT	BRICS
COM	0.773	-0.462	1.451	-1.246	-1.743	-0.848
ΔCOM	-10.364***	-8.614***	-6.200***	-4.442***	-5.226***	-3.816***
FDI	-0.479	0.302	-0.914	-0.872	-0.054	-1.121
ΔFDI	-3.654***	-2.260**	-2.880**	-6.024***	-6.093***	-5.970***
GDP	1.659	2.746	2.484	0.415	-0.252	0.950
ΔGDP	-4.640***	-4.806***	-1.927**	-2.820***	-3.528***	-2.254***
GCF	-0.405	-1.477	-1.349	-0.653	-2.137	-2.049
ΔGCF	-4.303***	-9.053***	-8.486***	-5.084***	-5.516***	-4.740***
MOB	-0.297	1.568	0.698	-0.199	-0.862	0.331
ΔMOB	-5.254***	-4.587***	-2.946***	-3.006***	-3.474***	-2.632***
SSE	0.835	1.744	1.115	-0.955	-0.820	-1.064
ΔSSE	-3.094***	-8.289***	-6.830***	-4.575***	-5.133***	-4.128***
TOP	0.155	-1.100	-0.053	-0.169	-1.977	-0.394
ΔTOP	-6.398***	-10.017***	-10.694***	-5.884***	-5.982***	-7.108***

Source: Authors' Computations***, **, & * imply significant at 1%, 5% and 10% respectively.

Since all of the variables are integrated of order one, the results of the unit root tests compel us to investigate whether there is a long-run relationship among the variables. The study uses Kao (1999) in Table 5 and Pedroni (2004) in Table 6 co-integration tests to determine whether the variables are co-integrated. Table 5 shows that the null hypothesis of no co-integration is rejected in MINT and BRICS countries when all the statistics are considered. While using the full sample (that is, all countries), three out of the five statistics in the Kao test and two in the Pedroni test reject the null hypothesis of no co-integration. The conclusion is a possible long-run relationship among the variables using the three samples (All countries, MINT countries, and BRICS countries). This, therefore, suggests that all the variables move together in the long-run and that all the

regressors employed in the model can empirically explain the level of economic complexity in MINT and BRICS countries.

Table 5. KAO Test for Panel Cointegration (H_0: No co-integration Vs H_a: All Panels are co-integrated)

	All Countries	MINT Countries	BRICS Countries
Modified Dickey-Fuller t	-1.824**(0.034)	-3.120***(0.0009)	-2.051**(0.020)
Dickey-Fuller t	-1.189(0.117)	-2.102**(0.017)	-2.086**(0.018)
Augmented Dickey-Fuller t	-3.062***(0.001)	-3.527***(0.0002)	-2.160**(0.015)
Unadjusted modified Dickey-Fuller t	-1.527*(0.063)	-3.086***(0.001)	-1.472*(0.070)
Unadjusted Dickey-Fuller t	-1.051(0.146)	-2.093**(0.018)	-1.886**(0.029)

Source: Authors' Computations, Augmented lags=1. Figures in ( ) are P-values. ***, **, & * imply significant at 1%, 5% and 10% respectively.

Table 6. Pedroni Test for Panel Cointegration (H_0: No co-integration Vs H_a: All Panels are co-integrated)

	All Countries	MINT Countries	BRICS Countries
Modified Phillips-Perron t	3.476***(0.0003)	1.515**(0.064)	3.165***(0.0008)
Phillips-Perron t	0.933(0.175)	-1.609*(0.053)	1.751**(0.040)
Augmented Dickey-Fuller t	1.923**(0.027)	-1.785**(0.037)	2.489***(0.006)

Source: Authors' Computations, Augmented lags=1. Figures in ( ) are P-values. ***, **, & * imply significant at 1%, 5% and 10% respectively.

FDI-Economic Complexity Nexus

In this section, we examine the impact of FDI on economic complexity using the three samples. The result for all countries pooled together is presented in Column 2 of Table 7, while Columns 3 and 4 present the results in MINT and BRICS countries. The study employs the Dynamic Ordinary Least Square (DOLS) technique after confirming that the variables of interest can have one or more co-integrating connections. Results for the entire sample, MINT, and BRICS countries are shown in Columns 1-3, respectively.

Table 7. Estimated Results Based on Panel Dynamic OLS

	All Countries	MINT Countries	BRICS Countries
FDI	0.074***	0.104***	-0.064***
	(0.000)	(0.000)	(0.000)
GDP	-0.00007	-0.00006	-0.0001***
	(0.853)	(0.881)	(0.000)
GCF	-0.005	-0.007	0.008**
	(0.333)	(0.154)	(0.052)
MOB	-0.018***	-0.015***	-0.013***
	(0.000)	(0.000)	(0.000)
SSE	0.064***	0.058***	0.071***
	(0.000)	(0.000)	(0.000)
TOP	0.006*	0.0005	-0.011***
	(0.011)	(0.838)	(0.000)
Wald chi^2	852.67***	656.94***	510.33***
	(0.000)	(0.000)	(0.000)
No of group	9	4	5
R-Squared	0.247	0.243	0.800

Source: Authors' Computations, Augmented lags=1. Figures in ( ) are P-values. ***, **, & * imply significant at 1%, 5% and 10% respectively.

As shown in table 7, FDI has a significant positive effect on economic complexity in all countries combined and MINT countries, while its effect on economic complexity in BRICS countries is negative and significant. The positive impact of FDI on economic complexity in all

countries and MINT countries suggests that foreign direct investment can improve product quality for the host country through technological advancement and skill spillovers. This further clarifies the claim made by Eck and Huber (2016), Hausmann (2016), Javorcik, Lo Turco, and Maggioni (2018), Khan et al. (2020), Saadi (2020), and Xu and Lu (2009) that FDI allows the transfer of knowledge, technology, management abilities that can encourage the production of more sophisticated goods. In other words, FDI is seen as one of the key drivers of economic complexity when all countries are pooled together, and MINT countries are considered. By manufacturing unique goods or services that have never been produced before and increasing the production of existing goods, FDI can further increase economic complexity, claim Antonietti and Franco (2021).

Surprisingly, the fact that FDI in BRICS countries might drive out domestic investment and economic activities can be used to explain the negative link between FDI and economic complexity in BRICS countries (see Nguyen & Su, 2021a, 2021b). In addition, if FDI inflows are low technology FDI (Arvanitis, 2005) or polluting FDI (Singhania & Saini, 2021), or are intended at natural resource rents (Bokpin, Mensah, & Asamoah, 2015; Ndikumana & Sarr, 2019; Nguyen & Su, 2021a, 2021b; Poelhekke & van der Ploeg, 2013), its impact on economic complexity can be negative. Despite the argument that China is the fourth largest destination for foreign investors, with $1491 billion in 2017 according to the UNCTAD (2018) in Khan et al. (2020), the BRICS countries still show a negative relationship between FDI and economic complexity. This may be explained by the fact that the other nations that joined China to form the BRICS countries are not performing well in foreign investment. Furthermore, the fact that FDI has a larger positive impact on economic complexity in MINT nations than in BRICS countries contributes to the good results observed across all the countries combined.

When examining the effects of all the included control variables, it is found that economic growth has a negative impact on economic complexity in each of the three samples, but this effect is only significant in the BRICS countries. This result contradicts the assertion made by Gala et al. (2018), Hartmann et al. (2017), Ivanova et al. (2017), Khan et al. (2020), Lapatinas (2019), Nguyen et al. (2020), Nguyen and Su (2021a, 2021b), and Saadi (2020) that a larger economic size s associated with higher levels of economic sophistication. It is surprising that economic growth negatively affects economic complexity in all three samples as seen in the study of Njangang, Asongu, Tadadjeu, and Nounamo (2021). Furthermore, capital investment has an insignificant negative effect (Lapatinas, 2019) on economic complexity both in the full sample and MINT countries. However, in the BRICS countries, there is a significant positive relationship between capital investment and economic complexity.

Contrary to the findings of Nguyen and Su (2021a), the positive effect of capital investment on economic complexity in BRICS countries means that capital investment can result in technological improvement that can support the production of more sophisticated products. Put differently, more efficient capital goods can increase efficiency and labor productivity, thus improving economic complexity. The effect of mobile cellular subscriptions on economic complexity in all three samples is significantly negative, indicating that mobile cellular subscriptions reduce economic complexity across the board. The explanation could be that most subscribers use their phones more for social interactions than for learning the skills and knowledge needed to increase economic complexity.

The research on human capital shows that the ability to produce goods depends heavily on human capital and that countries with higher levels of human capital can produce more complex goods than countries with lower levels of human capital (Costinot, 2009; Hausmann et al., 2014). In line with the studies of Chu (2020), Gao and Zhou (2018), Lapatinas (2019), Nguyen et al. (2020), Saadi (2020), and Zhu and Li (2017), to mention a few, human capital is positively related to economic complexity in all the samples. Also, the findings point to the fact that both MINT and BRICS countries are doing well in improving human capital, as measured by secondary school enrolment. Lastly, trade openness has a significant positive and negative effect on economic complexity in all countries and BRICS countries, respectively, while its impact on economic complexity is insignificantly positive in MINT countries. Trade openness having a positive effect on economic complexity in BRICS countries aligns with the findings of Bustos (2011), Gala et al.

(2018), Gao and Zhou (2018), Ghebrihiwet (2019), Keller (2010), Khan et al. (2020), Nguyen and Su (2021a), Saadi (2020), and Teixeira and Fortuna (2010). In contrast to MINT countries, where trade openness has a detrimental impact, BRICS countries use trade openness as an opportunity to advance technology and produce more sophisticated goods.

Conclusion

This study investigates the impact of foreign direct investment on economic complexity in MINT and BRICS countries between 1991 and 2020. The samples are divided into three categories: All countries pooled together, MINT and BRICS countries. This study employs panel co-integrating regression to show that foreign direct investment positively affects economic complexity in all the countries and MINT countries, while its effect is negative in BRICS countries. The surprising outcome is that FDI inflows have a reducing effect on economic complexity in BRICS countries. This result implies that while foreign direct investment increases economic complexity in the whole sample and MINT countries, it decreases it in BRICS nations.

As a result of these findings, governments in both MINT and BRICS countries should be concerned about the policies that will encourage FDI inflows into their respective countries. An investment promotion policy, for instance, is required to encourage foreign investment in the host country and contribute to the economic complexity of the host country. FDI inflows should be focused on highly technical investment. Thus, this study recommends future research to examine the sectoral analysis of how FDI affects economic complexity in MINT and BRICS nations.

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Economic Journal of Emerging Markets, 14(2) 2022, 271-286

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Available at https://journal.uii.ac.id/jep

The impact of oil price shocks on macroeconomic indicators: Evidence from four ASEAN countries

Adawiya Taufani[1*], Dedi Budiman Hakim[2], Widyastutik[3]

[1]School of International IPB University, Bogor, Indonesia
[2]International Center for Applied Finance and Economics (InterCAFE) IPB University, Bogor, Indonesia
[3]Department of Economics, Faculty of Economics and Management, IPB University, Bogor, Indonesia
[*]Corresponding author: adawiyataufani@apps.ipb.ac.id

Article Info

Article history:
Received 30 October 2021
Accepted 1 February 2022
Published 31 October 2022

JEL Classification Code:
Q43, O53, N15, C32

Authors' emails:
dbhakim@bima.ipb.ac.id
Widyastutik_ipb@yahoo.com

DOI: 10.20885/ejem.vol14.iss2.art10

Abstract

Purpose — This study examines the impact of oil price shocks on macroeconomic indicators, namely real GDP, real exchange rates, inflation, real interest rates, the balance of payments, and unemployment rates in four ASEAN countries, namely Brunei Darussalam, Malaysia, Indonesia, and Thailand.

Methods — This research uses a Vector Error Correction Model (VECM). The oil price variable in this study was divided into two, namely, the increase and decrease in oil prices based on the Mork transformation.

Findings — The analysis showed that the impact of price increases tended to encourage the economy of Brunei Darussalam and Malaysia. The shock of falling oil prices tended to cause a decline in the economy of Brunei Darussalam and Malaysia. The shock of rising prices tended to hamper the economies of Indonesia and Thailand. The shock of falling oil prices did not always positively impact the economy of the importing country, especially for the balance of payments.

Implication — These results show that price shocks will produce different economic responses. Understanding a country's macroeconomic framework is important before implementing effective policies.

Originality — These results expand the literature on the impact of oil price shocks on macroeconomic indicators in developing countries and small open economies, while studies related to macroeconomics generally focus on growth and inflation. This study also distinguishes oil price shocks into rising and falling oil price shocks using the Mork transformation.

Keywords: oil price shock, macroeconomics, VECM, ASEAN

Introduction

Oil plays a vital role in the modern economy of all countries (Huang, Hwang, & Peng, 2005), as fuel drives the economy. Demand and supply conditions affect the movement of oil prices. In addition, non-fundamental factors such as geopolitical conditions and weather disturbances also significantly affect fluctuations in oil prices (Feng, Xu, Failler, & Li, 2020). Oil price fluctuations affect a country's economy differently, depending on whether the country is an oil importer or exporter. Unexpected changes in oil prices significantly impact the volatility of macroeconomic and financial variables (Park & Ratti, 2008). Changes in oil prices can be an essential driver of macroeconomic uncertainty in the global economy.

P ISSN 2086-3128 | E ISSN 2502-180X

ASEAN consists of oil-exporting and importing countries. For a net oil exporter country, oil is a foreign exchange earner. The oil and gas sectors are the backbone of the Brunei Darussalam economy. The energy commodity exports contributed 57.7% to Brunei's GDP, 96.35% to total exports, and 87% to government revenue in 2019 (DEPS, 2020). The surplus of export value over import value makes Malaysia a net oil exporter (Jalil, Ghani, & Duasa, 2009). Energy exports contributed 30.9% to government revenue, 28.39% of total exports, and 20% to Malaysia's GDP. When there is an increase in oil prices, oil exporters will experience an increase in foreign currency inflows, which will lead to an appreciation of the exchange rate, low inflation, and low-interest rates, which can stimulate output growth and lead to increasing demand for inputs, such as labor. In addition, significant oil exports with high prices and relatively stable long-term accumulation of foreign assets provide a safe balance of payments for exporters. However, a positive oil price shock is also expected to hamper trade growth between oil exporters and other oil importers.

The role of oil for importing countries is different from that of exporting countries. For importers, oil is not a foreign exchange earner but can reduce the country's foreign exchange. Thailand is a net oil importer, with 76.8% of its oil needs coming from imports in 2018 (IEA, 2021). Indonesia's oil needs could only be met by domestic production of 50.86%, and the rest was met through imports in 2018 (IEA, 2021).

For oil-importing countries, rising prices will be followed by increasing production input prices, pushing production costs to encourage companies to reduce output. From a macroeconomic perspective, an increase in production input prices caused by the rise in oil prices will lead to a decline in the production of various industries and economic sectors. Changes in aggregate will result in a decrease in output and encourage an increase in unemployment. The rise in oil prices also increases the demand for foreign currency, which can reduce foreign exchange and increase capital outflows, resulting in depreciation. The depreciating exchange rate makes imported products more expensive, increases domestic inflation and interest rates, and causes a trade balance deficit in a certain period. For households, this will reduce the purchasing power of the people. Consequently, the industry will be compelled to lower production volumes and rationalize employees.

For the ASEAN region, energy demand, especially oil, tends to increase yearly. It is in line with the development and industrialization process in ASEAN countries. The demand for oil that is not proportional to the energy supply can lead to vulnerabilities in energy security. British Petroleum (2020) states that in the last ten years (2008 to 2018), petroleum consumption growth in the ASEAN region has been the highest compared to other areas and the world. ASEAN's oil consumption growth is 4.4% per year.

In comparison, world oil consumption growth is 1.3% per year, and other regions such as North America is 0.2%, South and Central America is 0.6%, Europe decreases 0.9%, CIS is 1.5%, the Middle East is 2.6%, and Africa is 2.2%. Unlike consumption in the last ten years, oil production in the ASEAN region has decreased by 1.24% per year, and not all countries in the ASEAN region produce oil (British Petroleum, 2020). The growth of oil consumption that is not followed by production growth can lead to vulnerability to energy security, especially oil, an energy source that is the primary need for a country in driving its economy. Energy security occurs when a country can meet the availability of endless energy resources and the affordability of prices (IEA, 2021).

Oil prices that often experience shocks or are highly volatile are not common conditions because they can disrupt the balance of a country's economy and create vulnerabilities in the energy sector. Therefore, analyzing the economy or macroeconomics of a nation can be used as an initial signal of whether the country is sensitive to oil price shocks caused by its significant dependence on oil, which can prevent and reduce the adverse effects of oil price shocks.

Several studies have examined the effect of oil price shocks on a country's economy. Ahmed, Bhutto, and Kalhoro (2019) found that oil price shocks significantly impacted several macroeconomic indicators of the five SAARC countries in the short and long term. Kitous et al. (2016) found that the decline in oil prices has a significant and negative effect on the GDP and revenues of oil-exporting governments; this is in line with Yildirim and Arifli (2021). However, Charfeddine and Barkat (2020) found different things where the decline in oil prices has no

significant effect on real GDP. Lorusso and Pieroni (2018) found that oil price shocks have a significant effect that causes a direct decline in GDP growth, an increase in inflation, the nominal interest rate, and the unemployment rate in the importing country. On the other hand, the finding of Gershon, Ezenwa, and Osabohien (2019) was different, where the increase in oil prices causes GDP per capita to increase in oil-importing countries.

The difference between this study and previous research is the region of the ASEAN region consists of developing countries and small open economies. Most studies concerned with the oil price shocks on the economy were carried out in developed countries and countries that export and import oil in large quantities. Research related to oil price shocks in ASEAN mainly examines its effect on the stock market. There are still not many studies on oil prices with the ASEAN macroeconomics. Studies related to macroeconomics generally only focus on growth and inflation, for example, research by Kriskkumar and Naseem (2019) and Razmi, Azali, Chin, and Shah Habibullah (2016). Therefore, this study expands the empirical literature by adding macroeconomic variables such as real GDP, real exchange rates, inflation, real interest rates, the balance of payments, and unemployment rates. The selection of these variables is made to proxy the economy's performance because oil price is one of the external factors that can affect a country's economy. Leading macroeconomic indicators are used to measure this based on data availability. Real GDP describes a measure of a country's economic growth that is better than nominal GDP because real GDP is not affected by price changes, the production of goods and services is measured at fixed prices; the real exchange rate is used to proxy economic competitiveness, inflation measures the rate of price changes over time, and the availability of money, actual interest rates to proxy purchasing power, the balance of payments describes a country's economic transactions related to the ability to absorb foreign exchange and foreign debt payments and the unemployment rate represents productivity to produce output. This study also distinguishes oil price shocks into rising and falling oil price shocks using the Mork transformation (1989) to provide better explanations. Based on the description above, this study aimed to determine the impact of oil price shocks on ASEAN macroeconomic variables.

Methods

This study uses quarterly data from 1995 to 2020 consisting of real GDP, real exchange rates, inflation, real interest rates, the balance of payments, and the unemployment rate in four ASEAN countries, namely Brunei Darussalam, Malaysia, Indonesia, and Thailand. The crude oil price data used was Brent Crude Oil. In the period 1995 to 2020, because during that period there were several financial and economic crises such as in 1997, 2001, 2008, Covid-19, 2020, political and economic instability in several oil-exporting and importing countries, then shocks to the sharp rise and fall of oil prices such as in 1999, 2006, 2008, 2011, 2016, and 2020.

VAR Stability Test

The VAR estimation is stable if all the roots have a modulus smaller than one and are located within the unit circle (Enders, 2004).

Vector Error Correction Model (VECM)

VECM is a restricted VAR used for non-stationary variables but has the potential to be cointegrated (Enders, 2004). This study used VECM because the variables were non-stationary at the level and cointegrated, implying a long-term relationship. An error correction mechanism was included in the model to capture the variations associated with adjustment for the long-term relationship. The selection of VECM helps distinguish between short-term and long-term dynamics and consists of a correction aspect called the error correction term (ECT). According to Lee, Ni, and Ratti (1995), Mork (1989) and Hamilton and Lin (1996), there is a nonlinear relationship between oil prices and macroeconomics. The nonlinear specification categorizes oil price shocks into positive ones for rising oil prices and negative ones for falling oil prices using the Mork transformation. This is done

to ensure better results and explanations. According to Mork, the variables that determine changes in oil prices can be stated as follows:

op_t^+ = max (0, (opt – opt-1)) or Δopt > 0, for rising oil prices (lnop_positive)
op_t^- = min (0, (opt – opt-1)) or Δopt < 0, for falling oil price (lnop_negative)

The VECM model specifications can be estimated for positive and negative shocks or rising and falling oil prices as follows:

$$\Delta \ln GDP_t = a_0 + \sum_{y=1}^{p} a_{1y}\Delta lnop^{+}_{t-1} + \sum_{y=1}^{p} a_{2y}\Delta lnop^{-}_{t-1} + \sum_{y=1}^{p} a_{3y}\Delta \ln GDP_{t-1} + \sum_{y=1}^{p} a_{4y}\Delta \ln rer_{t-1} + \sum_{y=1}^{p} a_{5y}\Delta inf_{t-1} + \sum_{y=1}^{p} a_{6y}\Delta rint_{it-1} + \sum_{y=1}^{p} a_{7y}\Delta \ln bop_{it-1} + \sum_{y=1}^{p} a_{8y}\Delta un_{it-1} - \lambda_1(\ln GDP_{t-1} + a_{12}lnop^{+}_{t-1} + a_{22}lnop^{-}_{t-1} + a_{42}\ln rer_{t-1} + a_{52}inf_{t-1} + a_{62}rint_{t-1} + a_{72}\ln bop_{t-1} + a_{82}un_{t-1}) + e_{1t} \quad (3)$$

$$\Delta \ln rer_t = b_0 + \sum_{y=1}^{p} b_{1y}\Delta lnop^{+}_{t-1} + \sum_{y=1}^{p} b_{2y}\Delta lnop^{-}_{t-1} + \sum_{y=1}^{p} b_{3y}\Delta \ln GDP_{t-1} + \sum_{y=1}^{p} b_{4y}\Delta \ln rer_{t-1} + \sum_{y=1}^{p} b_{5y}\Delta inf_{t-1} + \sum_{y=1}^{p} b_{6k}\Delta rint_{t-1} + \sum_{y=1}^{p} b_{7k}\Delta \ln bop_{t-1} + \sum_{y=1}^{p} b_{8y}\Delta un_{t-1} - \lambda_2(\ln rer_{t-1} + b_{12}lnop^{+}_{t-1} + b_{22}lnop^{-}_{t-1} + b_{32}\ln GDP_{t-1} + b_{52}inf_{t-1} + b_{62}rint_{t-1} + b_{72}\ln bop_{t-1} + b_{82}un_{t-1}) + e_{2t} \quad (4)$$

$$\Delta inf_t = c_0 + \sum_{y=1}^{p} c_{1y}\Delta lnop^{+}_{t-1} + \sum_{y=1}^{p} c_{2y}\Delta lnop^{-}_{t-1} + \sum_{y=1}^{p} c_{3y}\Delta \ln GDP_{t-1} + \sum_{y=1}^{p} c_{4y}\Delta \ln rer_{t-1} + \sum_{y=1}^{p} c_{5y}\Delta inf_{t-1} + \sum_{y=1}^{p} c_{6y}\Delta rint_{t-1} + \sum_{y=1}^{p} c_{7y}\Delta \ln bop_{t-1} + \sum_{y=1}^{p} c_{8y}\Delta un_{t-1} - \lambda_3(inf_{t-1} + c_{12}\Delta lnop^{+}_{t-1} + c_{22}lnop^{-}_{t-1} + c_{32}\ln GDP_{t-1} + c_{42}\ln rer_{t-1} + c_{62}rint_{t-1} + c_{72}\ln bop_{t-1} + c_{82}un_{t-1}) + e_{3t} \quad (5)$$

$$\Delta rint_t = d_0 + \sum_{y=1}^{p} d_{1y}\Delta lnop^{+}_{t-1} + \sum_{y=1}^{p} d_{2y}\Delta lnop^{-}_{t-1} + \sum_{y=1}^{p} d_{3y}\Delta \ln GDP_{t-1} + \sum_{y=1}^{p} d_{4y}\Delta \ln rer_{t-1} + \sum_{y=1}^{p} d_{5y}\Delta inf_{t-1} + \sum_{k=1}^{p} d_{6y}\Delta rint_{t-1} + \sum_{k=1}^{p} d_{7y}\Delta \ln bop_{t-1} + \sum_{k=1}^{p} d_{8y}\Delta un_{t-1} - \lambda_4\big(rint_{t-1} + d_{12}lnop^{+}_{t-1} + d_{22}lnop^{-}_{t-1} + d_{32}\ln GDP_{t-1} + d_{42}\ln rer_{t-1} + d_{52}inf_{t-1} + d_{72}\ln bop_{t-1} + d_{82}un_{t-1}\big) + e_{4t} \quad (6)$$

$$\Delta \ln bop_t = f_0 + \sum_{y=1}^{p} f_{1y}\Delta lnop^{+}_{t-1} + \sum_{y=1}^{p} f_{2y}\Delta lnop^{-}_{t-1} + \sum_{y=1}^{p} f_{3y}\Delta \ln GDP_{t-1} + \sum_{y=1}^{p} f_{4y}\Delta \ln rer_{t-1} + \sum_{y=1}^{p} f_{5y}\Delta inf_{t-1} + \sum_{y=1}^{p} f_{6y}\Delta rint_{t-1} + \sum_{y=1}^{p} f_{7y}\Delta \ln bop_{t-1} + \sum_{y=1}^{p} f_{8y}\Delta un_{t-1} - \lambda_5\big(\ln bop_{t-1} + f_{12}lnop^{+}_{t-1} + f_{22}lnop^{-}_{t-1} + f_{32}\ln GDP_{t-1} + f_{42}\ln rer_{t-1} + f_{52}inf_{t-1} + f_{62}rint_{t-1} + f_{82}un_{t-1}\big) + e_{5t} \quad (7)$$

$$\Delta un_t = g_0 + \sum_{y=1}^{p} g_{1y}\Delta lnop^{+}_{t-1} + \sum_{y=1}^{p} g_{2y}\Delta lnop^{-}_{t-1} + \sum_{y=1}^{p} g_{3y}\Delta \ln GDP_{t-1} + \sum_{y=1}^{p} g_{4y}\Delta \ln rer_{t-1} + \sum_{y=1}^{p} g_{5y}\Delta inf_{t-1} + \sum_{y=1}^{p} g_{6y}\Delta rint_{t-1} + \sum_{y=1}^{p} g_{7y}\Delta \ln bop_{t-1} + \sum_{y=1}^{p} g_{8y}\Delta un_{t-1} - \lambda_6\big(un_{t-1} + g_{12}lnop^{+}_{t-1} + g_{22}lnop^{-}_{t-1}g_{32}\ln GDP_{t-1} + g_{42}\ln rer_{t-1} + g_{52}inf_{t-1} + g_{62}rint_{t-1} + \sum_{y=1}^{p} g_{72}\ln bop_{t-1}\big) + e_{6t} \quad (8)$$

Note that op_t^+ is the transformation of the morphology of the increase in oil prices in year *t*, op_t^- is the transformation of the morphology of the decline in oil prices in year *t*, ln*rGDP*$_t$ is the real *GDP* of the country studied in year *t*, ln*rer*$_t$ is the real exchange rate of the country studied in year *t*, *inf*$_t$ is the rate inflation of the country studied in year *t*, ln*bop*$_t$ is the country's balance of payments studied in year *t*, *rint*$_t$ is the real interest rate of the country studied in year *t*, and *un*$_t$ is the unemployment rate of the country studied in year *t*, $\lambda_1 \dots \lambda_6$ are the short-run coefficients, $e_{1t} \dots e_{6t}$ represents white noise.

Results and Discussion

VAR Stability Test

The results of the VAR stability test show that the VAR system was stable because all its roots had a modulus that was smaller than one (please refer to the results in Table 1)

Table 1. VAR stability test results

Country	Modulus
Brunei Darussalam	0.095122 – 0.745615
Malaysia	0.180380 – 0.745902
Indonesia	0.051953 – 0.920989
Thailand	0.496165 – 0.866404

Vector Error Correction Model (VECM)

Based on Table 2, the long-term relationship of an increase in oil prices by one percent would cause an appreciation of the BND real exchange rate by 2.727 percent and real ringgit exchange rate 2.629 percent, a decrease in Brunei's inflation by 0.557 percent, and Malaysia's inflation by 1.858 percent, a decrease real interest rate by 4.105 percent and 4.156 percent, and a decrease in Brunei's unemployment rate by 2.881 percent and Malaysia's unemployment rate by 5.609 percent. Meanwhile, the long-term relationship between the increase in oil prices and Brunei's and Malaysia's real GDP was positive and significant, when there is an increase in oil prices by one percent, it will increase Brunei Darussalam's and Malaysia's real GDP by 12.718 percent and 0.775 percent. This is in line with Alekhina and Yoshino (2018), Charfeddine and Barkat (2020), Etornam (2015), and Mendoza and Vera (2010). The long-term relationship of the increase in oil price by one percent would decline Brunei's balance of payments by 1.352 and increase Malaysia's balance of payments by 2.223 percent. These results are in line with Faheem, Azali, Chin, and Mazlan (2020), and Shangle and Solaymani (2020).

Table 2. VECM estimation results of the long-term relationship between rising and falling oil price and Brunei Darussalam's, Malaysia's, Indonesia's, and Thailand's macroeconomics

lnop_ positif	BRN	MYS	IDN	THA	lnop_ negatif	BRN	MYS	IDN	THA
lnrgdp	12.718*	0.775*	-0.136*	-0.620*	lnrgdp	14.207*	0.831*	-0.444*	-0.627*
	[3.291]	[5.392]	[-6.036]	[-5.121]		[4.804]	[7.179]	[-2.797]	[-4.009]
lnrer	-2.727*	-2.629*	0.379*	1.623*	lnrer	-3.171*	-2.816*	0.125*	-1.642*
	[-3.163]	[-5.369]	[6.122]	[5.005]		[4.967]	[-7.156]	[2.818]	[4.052]
inf	-0.557*	-1.858*	1.979*	2.574*	inf	-1.935*	-1.991*	3.551*	1.603
	[-2.119]	[-5.504]	[5.804]	[5.229]		[-5.282]	[-5.504]	[2.756]	[1.979]
rint	-4.105*	-4.156*	7.154*	5.534*	rint	-1.427*	4.452*	2.368*	2.599
	[-2.319]	[-5.437]	[5.894]	[4.982]		[-5.067]	[7.157]	[2.750]	[1.928]
lnbop	-1.352*	2.223*	1.151*	2.306*	lnbop	1.707*	2.382*	3.808*	2.333*
	[-2.881]	[5.680]	[6.385]	[4.114]		[5.074]	[7.337]	[2.759]	[3.113]
un	-2.881*	-5.609*	2.629*	2.248*	un	-3.351*	-6.009*	0.870*	4.298*
	[-3.272]	[-5.367]	[6.229]	[5.117]		[-4.773]	[-7.164]	[2.739]	[4.035]

Note: entries with * sign show significance at the 5% significance level.

The long-term relationship between the decline in oil prices and Brunei's and Malaysia's real GDP was positive and significant. It means that when there is a decrease in oil prices by one percent, it will cause a decrease in Brunei's real GDP by 14.207 percent and Malaysia's real GDP by 0.831 percent. On the other hand, the decline in oil prices in the long term caused the depreciation of Brunei's real exchange rate by 3.171 percent and ringgit real exchange rate by 2.816 percent, rising inflation by 1.935 and 1.991 percent, Brunei's real interest rate by 1.427 percent, Brunei Darussalam's and Malaysia's unemployment rate by 3.351 and 6.009 percent and falling the balance of payments by 1.707 and 2.382 percent. This result is in line with Bala and Chin (2018) and Yildirim and Arifli (2021). Meanwhile, the relationship between the decline in oil prices with

Malaysia's real interest rates was positive, this means that when there is a decline in oil prices, the real interest rates will decrease. These results align with Shangle and Solaymani (2020).

The long-term relationship of oil price increases based on Table 2 shows that a one percent increase in oil prices causes Indonesia's and Thailand's real GDP to decrease by 0.316 percent and 0.620 percent. Meanwhile, an increase in oil prices by one percent will have an impact on the depreciation of the rupiah real exchange rate by 0.379 percent and Thai baht by 1.623 percent, an increase in inflation by 1.979 and 2.574 percent, interest rates by 7.514 and 5.534 percent, Indonesia's and Thailand's the balance of payments by 1.151 and 2.306 percent, and the unemployment rate by 2.629 and 2.248 percent. This result is in line with the findings of Al Rasasi and Yilmaz (2016), Etornam (2015), and Jiménez-Rodríguez and Sánchez (2005), who found that rising oil prices harmed economic activity in oil-importing countries studied. These results also align with other studies which found that rising oil prices caused depreciation in the top 6 African oil-importing countries (Saidu, Naseem, Law, & Yasmin, 2021), rising inflation in South Asian countries (Zakaria, Khiam, & Mahmood, 2021), and a negative contribution to the evolution of employment or an increase of unemployment rate in Spain as an oil-importing country (Ordóñez, Monfort, & Cuestas, 2019).

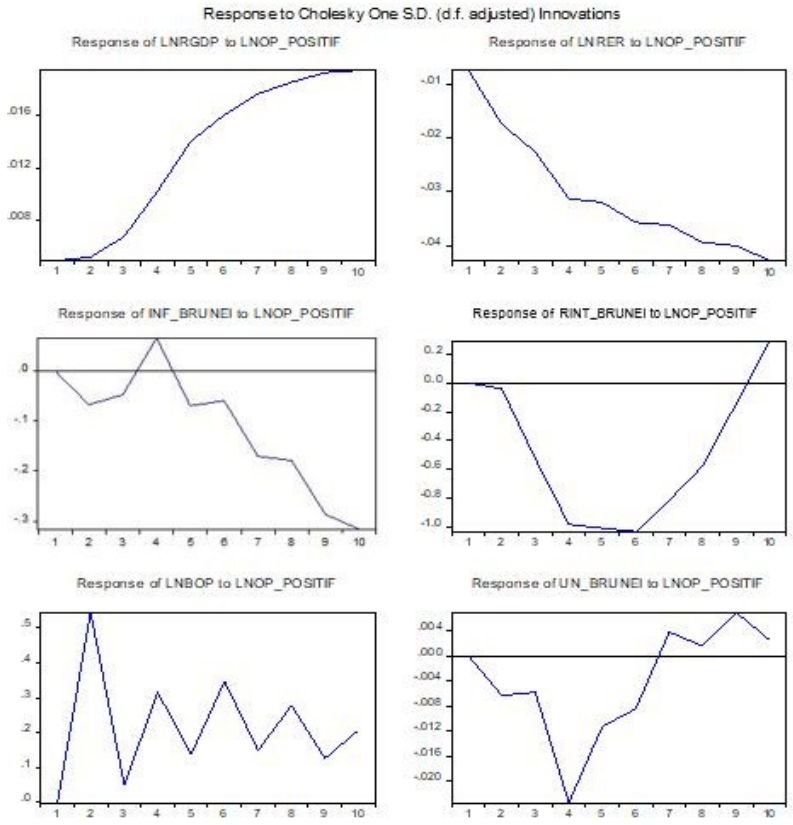
However, these findings are different from Jibril, Chaudhuri, and Mohaddes (2020) and Balli, Nazif Çatık, and Nugent (2021) who found that the increase in prices negatively impacts the trade balance of importers, but the findings are in line with Varlik and Berument (2020). This may be because Indonesia not only imports but also exports oil, where the increase in world oil prices will also be followed by an increase in the Indonesia Crude Price (ICP). In addition, the increase in oil prices was also related to the increase in the prices of other commodities such as coal and palm oil, which in turn would improve Indonesia's export competitiveness so that it could lead to an improvement in the trade balance and balance of payments. The increase in oil prices did not permanently affect the current account deficit because adjustments were needed to accommodate higher oil bills.

Table 2 shows that a long-term decline in the price of oil would lead to an appreciation of the real Thai baht exchange rate and real rupiah exchange rate, a decrease Indonesia's inflation and real interest rates by 3.551 percent and 2.368 percent, Indonesia's and Thailand's balance of payments, and Indonesia's and Thailand's unemployment rate. Meanwhile, in the long term, a one percent decline in oil prices will increase Indonesia's real GDP by 0.444 percent and Thailand's real GDP by 0.627 percent. This result is in line with Al Rasasi and Yilmaz (2016). The decline in oil prices did not necessarily make Indonesia's and Thailand's balance of payments increase. This might be caused by the appreciation that occurred due to the decline in oil prices or the reverse J-curve phenomenon.

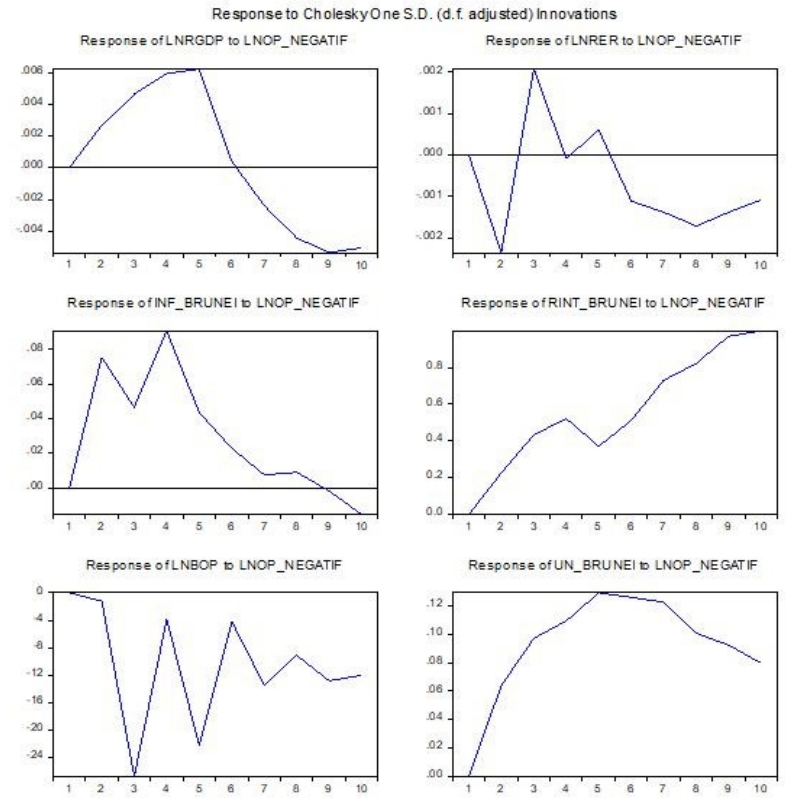
The shock of rising oil prices by one standard deviation resulted in Brunei's real GDP increasing from the 1st to the 10^{th} quarter. When oil prices experience a positive shock, it positively impacts government revenues, encourages an increase in government spending and investment, thereby stimulating an increase in exporter GDP. The response of the real exchange rate of the Brunei Darussalam dollar was negative or appreciated from the 1^{st} to the 10^{th} quarter. An increase in prices will cause the amount of foreign currency or the accumulation of foreign exchange entering the country to increase. It will lead to exchange rate stability which can make the exchange rate appreciated.

The shock of rising oil price decreased the inflation from 4^{th} to the 10^{th} quarter but not permanent, the real interest rates decreased until the 6^{th} quarter and then moved up again. The increase in oil prices leads to the appreciation of the exchange rate of oil-exporting countries, encouraging relatively low domestic inflation which will lead to relatively low-interest rates (Alekhina & Yoshino, 2018). The response of the balance of payments in the early quarter increased then tended to respond downwards until the 10^{th} quarter, but the response was still positive. This may be due to Brunei's undiversified export basket. When there is an increase in oil prices, the exchange rate of oil exporters appreciated and impacted the current account surplus for several periods after the appreciation of the domestic currency. Then, after several adjustments, the appreciation decreased the current account balance, which also reduced Brunei's balance of payments. The shock of rising

oil prices can disrupt the balance of payments, especially in countries that rely heavily on inflows from oil exports and do not have a diversified export basket (Ugwuanyi, 2011).

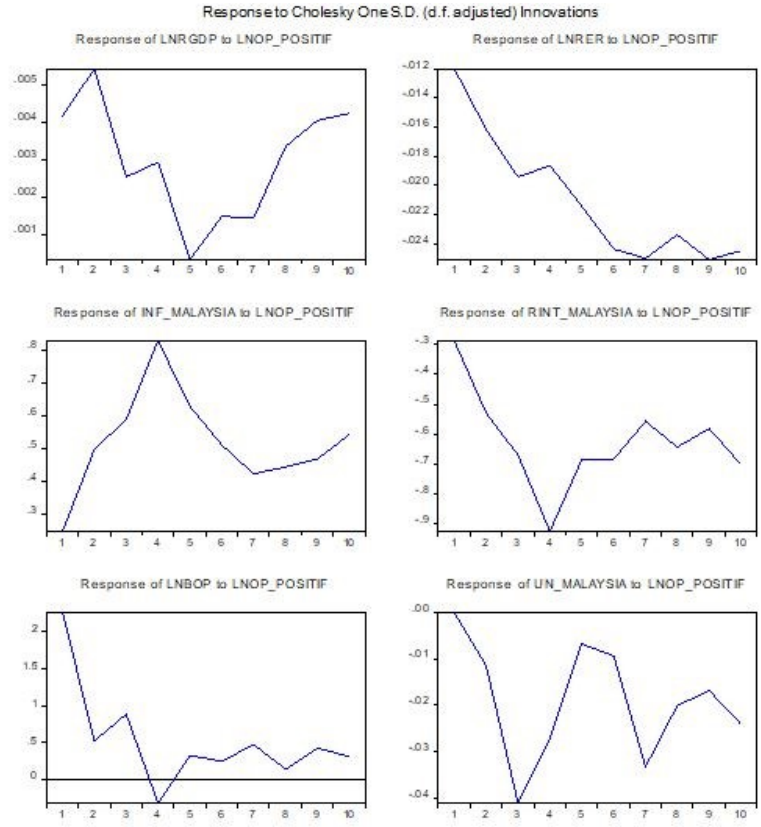


(a)

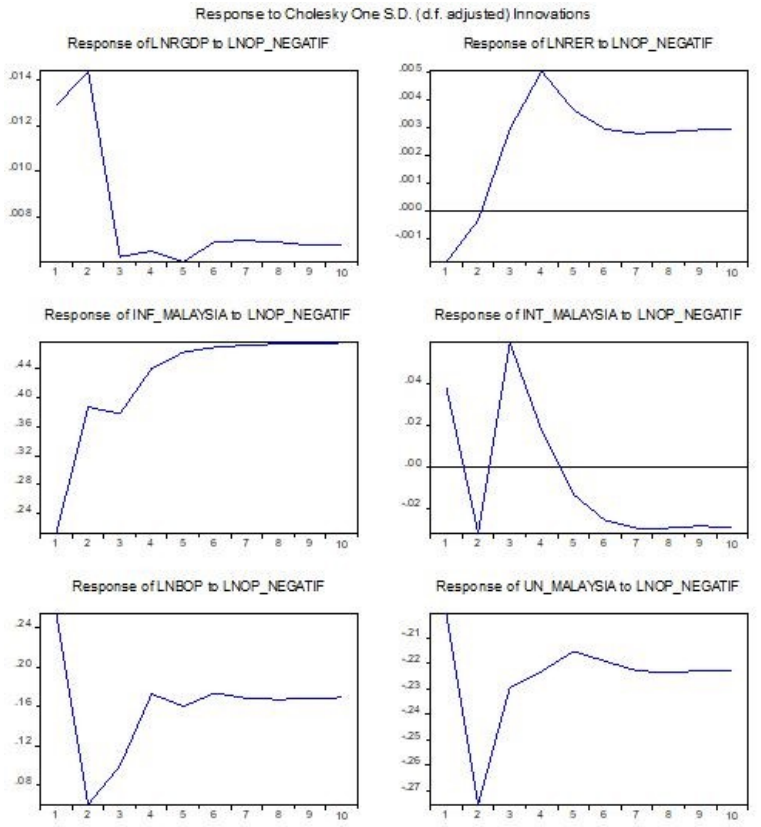


(b)

Figure 1. Brunei Darussalam IRF Results: (a) rising shock (b) falling shock



(a)



(b)

Figure 2. Malaysia IRF Results: (a) rising shock (b) falling shock

The response of Brunei's unemployment rate decreased until the 4th quarter then moved up again in the 5th quarter due to the shock of rising prices. This result is in line with the findings

of Cuestas and Gil-Alana (2018). However, Brunei's unemployment rate, which rises again after some time, was due to the mindset of young Bruneians who want jobs in the government because they are considered secure, not risky, have job security, and have attractive benefits compared to the private sector (Musa & Rozaidah, 2020), but employment opportunities in the government are limited.

The shock of falling oil prices by one standard deviation at the beginning of the quarter resulted in Brunei's real GDP increasing until the 6th quarter and then continued to decline, the real exchange rate depreciated until the 3rd quarter, then tended to appreciate again, inflation increased, and began to decline in the 6th quarter, interest rates increased, the balance of payments was negative, and the unemployment rate continued to rise until 5th quarter. The balance of payments tended to respond negatively is in line with Sakanko and David (2019).

The impact of the shock of rising and falling oil prices on Malaysia's macroeconomic indicators can be seen in Figure 2. The shock of rising oil prices was responded to positively by Malaysia's real GDP. However, Malaysia's real GDP response tended to decline until the 5th quarter, and then it rose again in the 6th to 10th quarters. The response of the Malaysian Ringgit real exchange rate to the shock of rising oil prices was negative or appreciated until the 10th quarter. Malaysia's inflation response to the shock of rising oil prices was positive and continued to increase until the 5th quarter, but after the 5th quarter, this response began to decline. This result aligns with Majuca's (2020) findings, which show that the increase in oil price positively impacts Malaysian inflation because the increase in oil prices will slowly be incorporated into the prices of other goods and services until a new equilibrium is reached. The trend of rising inflation in the first few quarters and then declining in the following quarters indicates that high oil prices was the driving force for companies to upgrade to modern manufacturing technologies that were not energy-intensive and consumers cut their consumption of energy-intensive products. This can help prevent economic indicators from being adversely affected by oil price shocks.

Malaysia's real interest rates respond negatively to the shock of rising oil prices, which was not in line with the response to inflation. This result is in line with Shangle and Solaymani's (2020) research, which found that, based on the CGE model, when the government's target is to minimize the inflation rate, the effective policy is to reduce interest rates as a response to rising oil prices, meanwhile when the government's target is to achieve the level of employment and investment, the effective policy is to reduce the reserve ratio. Oil price shocks began to be responded positively by the balance of payments in the 1st to 3rd quarters. In the 4th quarter, the balance of payments responded negatively to the shock of rising oil prices, namely -0.313721. The response was positive again in the 5th quarter to the 10th quarter. The effect of the shock of one standard deviation of the oil price on Malaysia's unemployment rate began to be responded negatively in the second quarter or tended to decline until the 10th quarter, namely 0.024053.

Malaysia's real GDP response to the shock of falling oil prices was positive but tended to move downwards until the 10th quarter. The shock of falling oil prices tended to make the real ringgit exchange rate depreciate. The shock of falling oil prices was responded to positively by inflation and continued to increase until the 10th quarter. The response of the real interest rates to the shock of the decline in oil prices tended to be negative, except in the 1st, 3rd, and 4th quarters were positive. The shock of falling oil prices was responded positively by Malaysia's balance of payments but declined until the 2nd quarter, then rose again in the 3rd quarter and was relatively stable until the 10th quarter.

Figure 3(a) shows Indonesia's and Thailand's macroeconomic response to the shock of rising oil prices. The shock of rising oil prices tends to be responded negatively and decline by the real GDP of Indonesia from the 3rd to the 10th quarter and Thailand's real GDP from the first to the 10th quarter. For oil-importing countries, an increase in oil prices would be followed by an increase in production input prices, leading to a decline in the production of various industry and economic sectors. This aggregate change would result in a decrease in output, which could encourage a decrease in government spending and investment, leading to a decrease in real GDP. In addition, rising oil prices adversely affect investment due to the increase in company costs (Jiménez-Rodríguez & Sánchez, 2005).

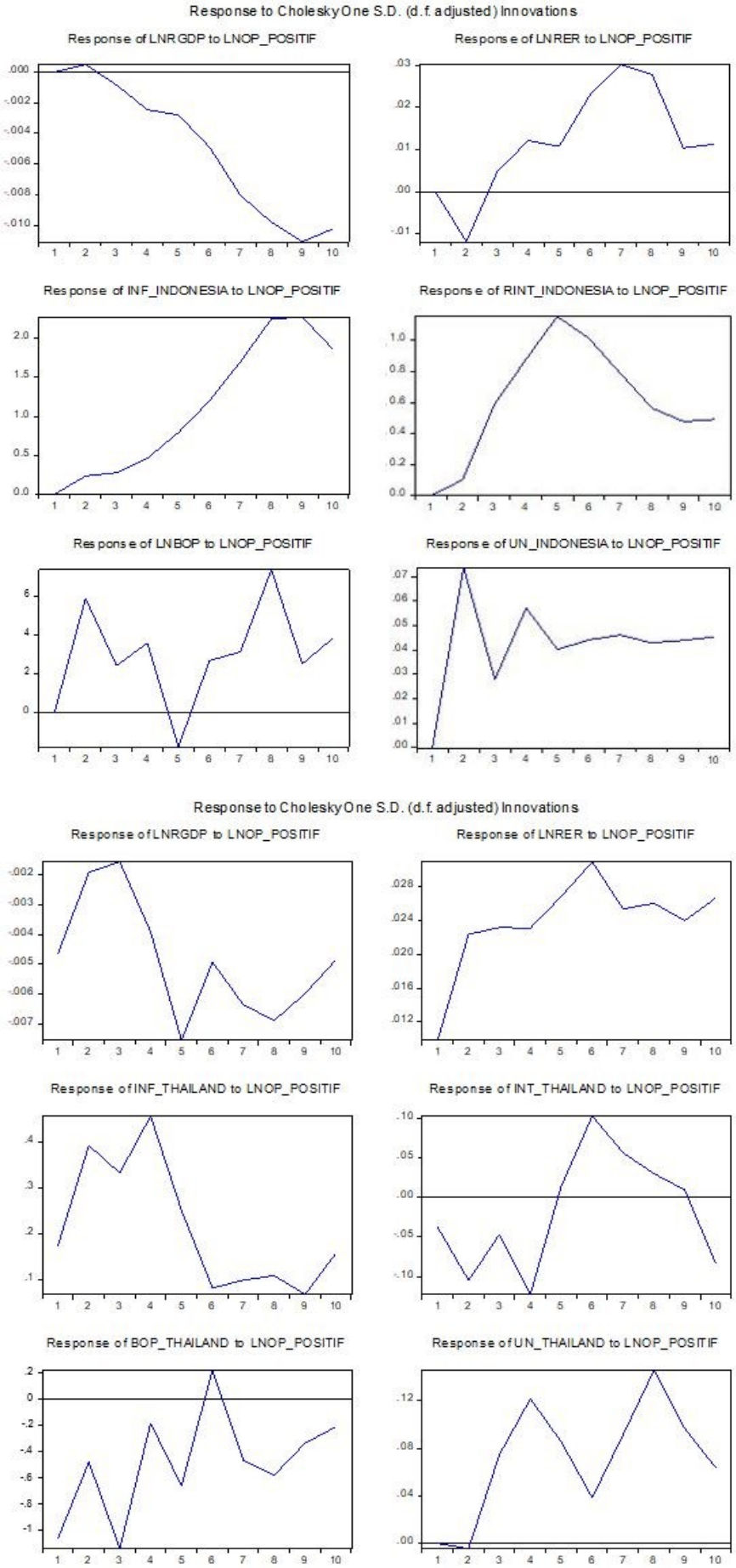


Figure 3a. Indonesia and Thailand IRF Results: rising shock

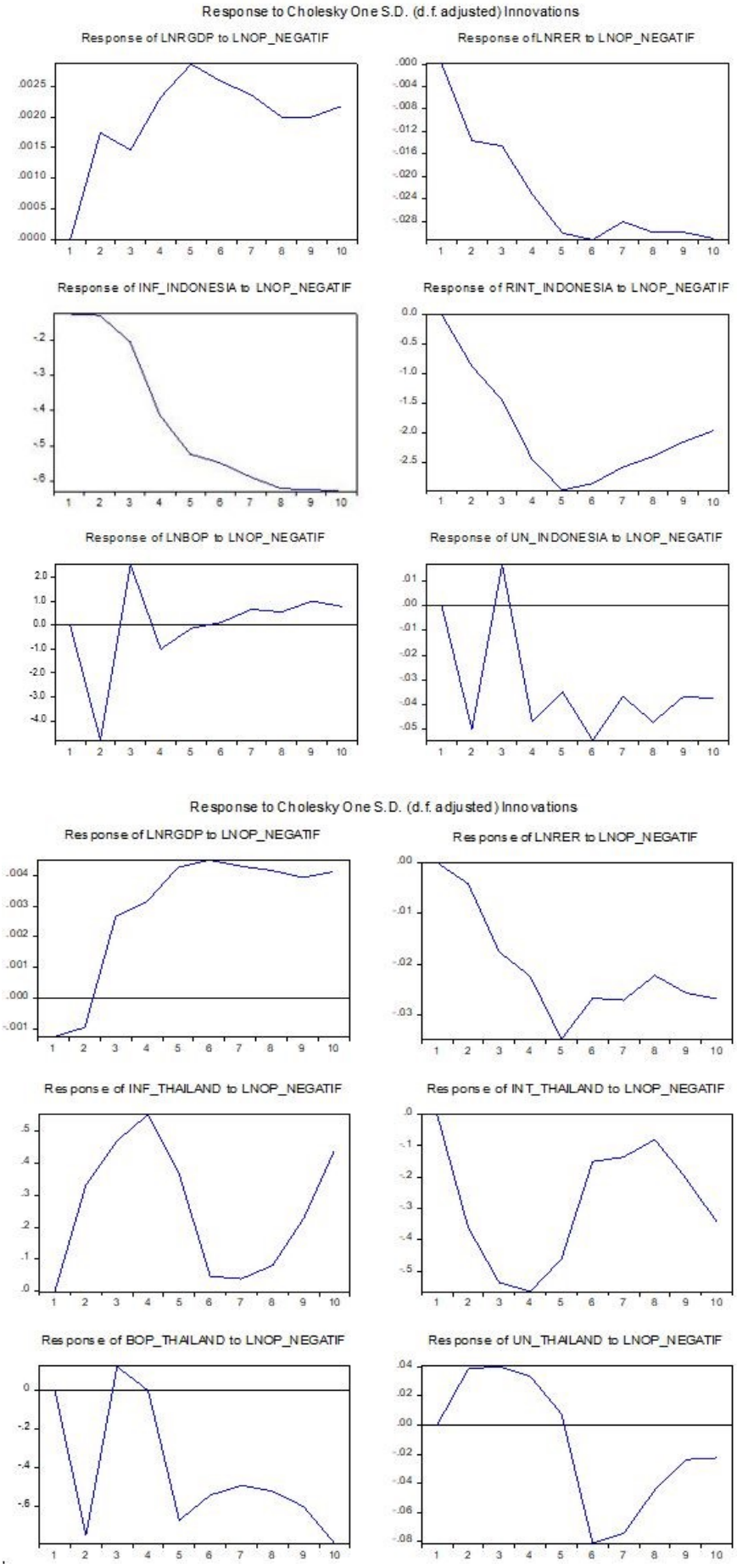


Figure 3b. Indonesia and Thailand IRF Results: falling shock

The response of the real exchange rate of the Indonesian rupiah and Thai baht to the shock of rising oil prices tended to be positive and continue to move up or depreciate. This increase in oil prices would impact the increasing demand for foreign currency, leading to a weakening or depreciation of the domestic exchange rate against the USD. The shock of rising oil prices was responded positively by Indonesia's and Thailand's inflation and continued to increase until the 9th quarter for Indonesia and tended to move up from the 1st to the 4th quarter for Thailand, then declined. The increase in oil prices causes input prices to rise, resulting in production costs and consumer prices rising.

The real interest rate response to the shock of rising oil prices was positive and continued to move up until the 5th quarter for Indonesia. The response of Thailand's real interest rates is not in line with the inflation response due to the shock of rising oil prices. For Thailand, when inflation declined, lowering interest rates was ineffective due to high household debt problems and the risk of financial instability associated with a possible increase in US interest rates. Therefore, the Bank of Thailand carried out the handling related to the decrease or increase in inflation by loosening or tightening capital controls and foreign exchange market intervention (Kumaga, 2018).

The response of Indonesia's balance of payments to the shock of rising oil prices tended to be positive and fluctuated, except in the 5th quarter, which responded to -1.793631 and increased again in the 8th quarter, namely 7.343895. The response of Thailand's balance of payments to the shock of rising oil prices was negative but tended to move up until the 6th quarter. The findings on the balance of payments align with Varlik and Berument (2020). The increase in oil prices did not permanently affect the current account deficit because adjustments were made. The increase in Thailand's balance of payments may have resulted from balancing the current account balance by an increase in exports due to depreciation or a decrease in exports in sectors that used much energy in their production. The shock of rising oil prices will increase Indonesia's and Thailand's unemployment rates.

Table 3. Variance decomposition in Brunei Darussalam, Malaysia, Indonesia, and Thailand

Shock source			lnop_positive				lnop_negative					
Variance response	lnrgdp	lnrer	inf	rint	lnbop	un	lnrgdp	lnrer	inf	rint	lnbop	un
Brunei Darussalam												
Q2	27.87	38.17	3.06	0.07	20.55	23.82	1.46	7.26	1.38	3.06	3.61	2.02
Q4	37.58	33.43	16.79	0.54	10.57	25.92	1.67	4.72	0.82	3.16	3.12	1.22
Q6	50.28	24.29	25.72	0.44	6.99	21.82	2.33	4.27	0.67	3.67	2.7	2.06
Q8	51.34	17.31	30.5	0.27	4.54	14.71	1.87	4.53	0.57	3.21	2.44	2.49
Q10	46.35	12.62	32.64	0.14	2.96	9.14	2.14	4.75	3.06	2.69	2.23	2,35
Malaysia												
Q2	5.4	10.88	18.96	22.23	15.88	0.76	40.17	0.22	11.09	0.15	1.53	50.4
Q4	3.9	10.86	30.75	35.64	13.26	1.82	31.09	1.21	9.88	0.19	1.27	54
Q6	3.1	12.35	35.3	41.79	11.12	1.49	28.36	1.22	10.06	0.1	1.27	55.3
Q8	3.07	13.49	35.77	43.3	9.66	1.77	27.17	1.29	10.01	0.08	1.27	56.4
Q10	3.66	14.27	36.6	44.44	8.66	1.83	26/22	1.19	10.11	0.07	1.28	57
Indonesia												
Q2	10.16	10.48	10.18	10.12	1.86	18.01	7.84	3.98	1.94	3.52	3.68	1.43
Q4	10.97	12.73	10.7	10.53	2.55	18.19	6.73	3.79	4.9	5.98	2.95	1.06
Q6	12.81	15.95	11.89	11.47	3.33	26.85	6.4	6.14	6.38	7.2	2.57	1.01
Q8	17.04	18.43	14.24	13.28	3.93	37.35	5.95	7.15	8.99	8.6	2.25	1.16
Q10	19.29	17.5	15.27	15.92	5.88	38.37	5.72	7.73	10.58	11.7	1.99	1.09
Thailand												
Q2	5.32	10.61	7.41	7.91	6.37	2.52	1.21	0.58	2.44	2.17	7.28	1.09
Q4	3.82	14.02	7.6	9.02	9.63	8.58	1.3	3.84	2.79	3.22	6.38	1.95
Q6	6.38	18.05	8.63	9.88	9.65	8.6	1.05	8.99	3.58	4.19	9.68	1.73
Q8	7.35	18.92	10.58	10.73	9.53	11.61	1.07	9.69	3.59	4.73	11.07	1.62
Q10	7.56	19.12	14.82	11.83	9.04	11.89	1.14	10.4	4.27	6.48	14.58	1.29

The shock of falling oil prices was responded to positively by the real GDP of Indonesia and Thailand for several quarters and the response of real GDP begins to move downward differently but remains positive. The decline in oil prices would make production costs cheaper. It could stimulate an increase in production, make the prices of export products that used imported inputs more competitive and efficient, and increase the growth rate, ultimately impacting real GDP. The falling oil prices caused an appreciation of the Rupiah and Thai baht real exchange rate, decrease in inflation, and real interest rate. Indonesia's balance of payments response to the shock of falling oil prices was initially negative. However, in the third quarter, the balance of payments response moved up and was positive. The response of Thailand's balance of payments to the shock of the decline in oil prices tended to be negative. This shows that the shock of falling oil prices does not always positively impact the balance of payments of oil importers because a decline in oil prices can cause prices to decline in certain export commodities. The shock of falling oil prices tended to impact reducing unemployment rates in Indonesia and Thailand.

From Table 3, the results of the variance decomposition of the shocks of rising oil prices, in general, contributed more to explaining changes in the variance of macroeconomic indicators of ASEAN countries or macroeconomic indicators that ASEAN countries were more vulnerable to shocks to rising oil prices than shocks to falling prices. The shock of falling oil prices only contributed more than the shock of rising oil prices in explaining some changes in the variance of macroeconomic variables, namely Brunei Darussalam's real interest rate, Malaysia's real GDP and unemployment rate, and Thailand's balance of payments, or they can be said that these variables were more sensitive to the shock of falling oil prices.

Conclusion

Based on the results and discussion that have been described, it can be concluded that the increase and decrease in oil prices in the long term, in general, have a significant effect on all macroeconomic indicators analyzed in ASEAN countries, except for inflation and Thailand's real interest rate when oil prices decline. This shows that the macroeconomic indicators of the ASEAN countries studied are vulnerable to changes in oil prices. The increase in oil prices has a positive effect on the economy of Brunei and Malaysia because the increase in oil prices causes the country's real GDP to rise, the real exchange rate of the Brunei dollar and Malaysian ringgit appreciates, inflation decreases, interest rates decline, and unemployment rates decrease, but not for Brunei's balance of payments.

In the long term, the increase in oil prices impacted the decline in real GDP of Indonesia and Thailand, the depreciation of the real exchange rate of the rupiah and Thai baht, and the rise of inflation, real interest rates, the balance of payments, and unemployment rates of Indonesia and Thailand. The shock of falling oil prices does not always have a positive impact on the economy of the importing country, especially on the balance of payments, because it causes a decrease in the balance of payments in oil-importing countries

The shock of an increase and a shock of a decrease in oil prices by one standard deviation based on the results of the IRF has different impact and response to the macroeconomics of ASEAN countries. The shock of rising prices tends to boost the economy of Brunei Darussalam and Malaysia. The shock of falling oil prices tends to cause a decline in the economy of Brunei Darussalam and Malaysia. The shock of rising prices tends to hamper the economies of Indonesia and Thailand. This difference in response was caused by the dependence on oil in the energy mix, net oil imports per GDP, the efficiency of energy production, the country's export level, and income and savings from international trade.

Therefore, it is important to understand a country's macroeconomic framework before implementing policies that effectively mitigate the adverse effects of rising or falling oil prices. This study provides some policy suggestions for the four ASEAN countries. First, cooperation among ASEAN countries must be increased, for example, in terms of policies related to energy consumption, especially petroleum, energy diversification by investing in mixed substitute fuels and alternative renewable fuels, adoption of new technologies that use alternative energy, and cooperation in infrastructure development for alternative energy. ASEAN can become an exporter

of biofuels or other alternative energy because of the wealth of natural resources, especially biodiversity and agriculture. The efficiency of the use of petroleum should be carried out, especially in the transportation sector. The government, in this case, the monetary authority (central bank) in ASEAN countries, should prioritize the impact of oil prices on inflation through interest rates and maintaining exchange rate stability. The government can use a hedging strategy by using futures contracts. Brunei Darussalam can diversify its economy to reduce the adverse effects of oil price shocks.

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P ISSN 2086-3128

E ISSN 2502-180x