

Journal of Economic Cooperation & Development

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Editorial

This issue of the Journal of Economic Cooperation and Development includes eight papers that revolve around studying the impacts of various variables and new sectors on economic growth and trade. The authors of these papers used different applications of modern econometric techniques and, based on their findings, suggested relevant recommendations for future work of both practitioners and researchers.

In the paper titled “Entrepreneurship and Economic Performance: Evidence from Selected OIC Countries”, Mohsen Mohammadi Khyareh and Hadi Amini studied the causal relationships between entrepreneurship, income inequality, poverty, employment, and economic growth in the panel of 22 OIC countries during the period 2012-2017. The results suggested that entrepreneurship plays a vital role in economic growth, which may help the economies of these countries grow and bridge existing gaps.

In his paper titled “Health Expenditure, Economic Growth and Life Expectancy at Birth in Resource Rich Developing Countries: A case of Saudi Arabia and Nigeria”, Yusuf Opeyemi Akinwale investigates the relationship between health expenditure and life expectancy at birth, and economic growth in resource rich developing countries namely Saudi Arabia and Nigeria. The results show that economic growth in the long-term is positively influenced by health expenditure and life expectancy. Furthermore, the results reveal that, in the short-term, while both health expenditure and life expectancy are positively influenced economic growth in Saudi Arabia, only health expenditure has a positive impact on economic growth in Nigeria.

The paper by Şerif CANBAY titled “Electricity Consumption and Economic Growth in D8 Countries: Bootstrap Panel Causality”, finds a positive and unidirectional causality relationship between electricity consumption and economic growth (the growth hypothesis) in Iran and between economic growth and electricity consumption in Indonesia and Nigeria (the conservation hypothesis). For Egypt and Malaysia, a positive and bidirectional causality relationship (the feedback hypothesis) is determined between the variables, while no causality (the neutrality hypothesis) relationship is found between the same variables in Bangladesh, Pakistan, and Turkey.

In their paper titled “Effect of Liquidity and Credit Risk on Banking Performance: Evidence from Sub Saharan Africa”, Adamu Yahaya, Fauziah Mahat, and M.H. Yahya found that liquidity risk and credit risk are separately and jointly significant and they both negatively contribute to the performance of

banks in Sub Saharan Africa. Based on these results, the authors encourage management and practitioners to employ necessary measures to mitigate this.

The authors of the paper titled “Is Profitability of Islamic Banks Shaped by Bank-specific Variables, Global Financial Crisis and Macroeconomic Variables?”, investigated the determinants of Islamic banks’ (IBs) profitability. Their findings indicate that asset quality, capital adequacy, and non-financial activity play significant roles in determining the profitability of IBs. Furthermore, the results show that IBs are not affected by the GFC, as they are less exposed to international banks and do not grant subprime loans; IBs could maintain better capital ratios during the GFC, which shielded them from the severe effects of the crisis. On the other hand, the results showed that profitability would be reduced by increases in asset quality, liquidity, and deposit ratio.

The paper titled “Comparing the long term growth-enhancing effect of RCEP and CPTPP: Evidence from Malaysia” compares the growth-enhancing effect of RCEP and CPTPP for the Malaysian economy. The RCEP is found to have a long-run relationship with Malaysia’s Industrial Production Index (IPI). The paper shows no cointegration relationship between IPI and total exports to member countries of CPTPP where the growth-enhancing effect of RCEP is more significant than CPTPP.

The authors of the paper titled “A method for preparing multi-regional input-output tables despite data limitation: FLQ-Gravity,” used the base gravity model to estimate trade between regions, where data is often incomplete and/or messy. When there is no interregional trade data, this model can partially estimate interregional trade based on the three factors of production, demand and distance. For this purpose, first, a single region input-output table is prepared by the FLQ method. Then, trade between regions is estimated using the gravity method.

In his paper titled “How do EFI and CPI impact foreign direct investment (FDI) inflows in selected emerging markets?,” Mehmet Canakci determined the impact of the economic freedom index and corruption perceptions index on foreign direct investment in selected emerging markets. The empirical results showed that the relationship between corruption perceptions index and foreign direct investment is positive. The effect of CPI was significant among the long-term parameters with a 1 % increase attributing to FDI increases of 7% significant level.

Nebil DABUR
Editor-in-chief

Entrepreneurship and Economic Performance: Evidences from Selected OIC Countries

Mohsen Mohammadi Khyareh¹ and Hadi Amini²

ABSTRACT

The OIC countries encountered problems concerning reduction of poverty, filling gaps between income inequalities and achieving economic development. Thus, the main question to ask was: “What can be the solution?” Furthermore, entrepreneurship and economic growth had an increasing pattern. Hence, many scholars have highlighted the importance of economies’ entrepreneurial activities and the impact of entrepreneurship and economic growth on poverty, income inequality and economic development. Meanwhile, studies that are quantitatively analyzing the interrelationship between entrepreneurship and their impact on economic performance are very limited. Therefore, the aim of this study is to fill the gap in entrepreneurship literature and to study the causal relationships between the entrepreneurship, income inequality, poverty, employment and economic growth in the panel of 22 OIC countries during 2012-2017. The results suggested that entrepreneurship plays a vital role on poverty, income inequality, employment and economic growth in the OIC countries.

ملخص

تواجه بلدان منظمة التعاون الإسلامي مشاكل تتعلق بالحد من الفقر وسد الفجوات بين التفاوتات في الدخل وتحقيق التنمية الاقتصادية. وفي هذا السياق، يتمثل السؤال الرئيسي الذي يتعين علينا أن نطرحه في: ما هو الحل الممكن؟ وعلاوة على ذلك، يعرف كل من مجالي تنظيم المشاريع والنمو الاقتصادي نمطا تصاعديا، بحيث أبرز العديد من الباحثين أهمية أنشطة تنظيم المشاريع في الاقتصادات وتأثيرها فضلا عن النمو الاقتصادي على الفقر وعدم المساواة في الدخل والتنمية الاقتصادية. وفي الوقت نفسه، فإن الدراسات التي تحلل من الناحية الكمية العلاقة المتبادلة بين

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تنظيم المشاريع وتأثيرها على الأداء الاقتصادي محدودة جدا. ولذلك، فإن الهدف من هذه الدراسة هو سد الفجوة القائمة في الأدبيات المتعلقة بتنظيم المشاريع ودراسة العلاقات السببية بين تنظيم المشاريع، وعدم المساواة في الدخل، والفقر، والعمالة، والنمو الاقتصادي في مجموعة تتكون من 22 بلدا من بلدان منظمة التعاون الإسلامي خلال فترة 2012-2017. وتشير النتائج إلى أن تنظيم المشاريع يؤدي دورا حيويا في مجالات الفقر وعدم المساواة في الدخل والعمالة والنمو الاقتصادي في بلدان المنظمة.

ABSTRAITE

Les pays de l'OCI ont rencontré des problèmes concernant la réduction de la pauvreté, le comblement des inégalités de revenus et la réalisation du développement économique. Ainsi, la principale question à poser était la suivante : "Quelle peut être la solution ?" En outre, l'esprit d'entreprise et la croissance économique ont connu une évolution croissante. Ainsi, de nombreux chercheurs ont souligné l'importance des activités entrepreneuriales des économies et l'impact de l'entrepreneuriat et de la croissance économique sur la pauvreté, les inégalités de revenus et le développement économique. Cependant, les études qui analysent quantitativement l'interrelation entre l'entrepreneuriat et son impact sur la performance économique sont très limitées. Par conséquent, l'objectif de cette étude est de combler le vide dans la littérature sur l'entrepreneuriat et d'étudier les relations causales entre l'entrepreneuriat, l'inégalité des revenus, la pauvreté, l'emploi et la croissance économique dans le panel de 22 pays de l'OCI au cours de 2012-2017. Les résultats suggèrent que l'entrepreneuriat joue un rôle essentiel sur la pauvreté, l'inégalité des revenus, l'emploi et la croissance économique dans les pays de l'OCI.

Keywords: economic growth; entrepreneurial behavior; poverty, income inequality, employment

JEL Classification: L26, D63, E24, O4

1. Introduction

Over the past three decades, the role of entrepreneurship in economic growth has been one of the major research topics (King and Levine, 1993; Wennekens and Thurik, 1999; Acs and Szerb, 2007). In an effort to adapt to the importance of entrepreneurship, governments around the world have adopted various policies to enhance competitiveness, focusing on factors such as appropriate tax regimes, subsidies, growth and investment,

innovation, or simple business rules. Small and medium businesses (Acs and Stough, 2008).

Entrepreneurship is believed to be an important mechanism of economic growth and development (Schumpeter, 1934). Their role is to promote prosperity by creating new jobs (Van Stel and Storey, 2004), reducing unemployment (Evans and Leighton, 1989), and increase economic development and growth of a region (Acs et al, 2008). They also increase productivity by bringing innovation and speed up structural changes by forcing existing business to reform and increasing competition. However, even the previous literature examining the relation between income distribution and innovation has neglected economic agents who implement innovation: entrepreneurs. It is puzzling that existing studies have not provided much room for entrepreneurs who can mediate between income inequality and economic growth. To the best of our knowledge, only a few studies have examined the relationship between income distribution and economic growth by considering the role of entrepreneurship (Gutiérrez-Romero & Méndez-Errico, 2015; Tselios, 2011).

In the existing literature on entrepreneurship, much research has not been done the direct relationship between entrepreneurship and economic performance. Thus, the main purpose of this paper is to examine the relationship between entrepreneurship and economic growth. Contrary to previous studies, with a comprehensive insight into examining all aspects of economic performance using available data for the 22 OIC countries, the potential impacts of the entrepreneurship on the economic growth, poverty, income inequality and employment of selected OIC member countries are examined. Regarding the main purpose of the research, as well as the importance of government policies in developing entrepreneurial activities and creating an appropriate business environment, the main question to be taken into consideration is as follows:

1. How does the entrepreneurship affect the promotion of economic performances?
2. What is the contribution of entrepreneurship to the economic development through employment generation, GDP growth, poverty alleviation and income inequality?

The results of this study can be helpful in policymaking governments to stimulate entrepreneurial activities and economic performances. Moreover, entrepreneurs can be more effective in choosing their business and developing it, knowing the competitive advantages of countries.

The structure of the present paper organized as follows: In the second part, the theoretical foundations of the research presented in which the concept of the competitiveness of countries and the impact of the components of competitiveness on entrepreneurial activity explained; in the third section, the methodology of research and data is presented. Section three, provides a detailed explanation of the method and data collection. In the fourth section, empirical analysis is performed and in Section 5 the conclusions of the research are stated.

2. Literature and research hypotheses

The literatures about impact of entrepreneurship on poverty and income inequality are small. Kimhi (2010), mentioned in his study that the conventional wisdom has been to associate entrepreneurship with higher inequality because of the risk embodied in it. By using the inequality decomposition techniques, he has given the conclusion of his study about entrepreneurship and income inequality in Southern Ethiopia that a uniform increase in entrepreneurial income reduces per capita household income inequality but increasing the number of entrepreneurs does not affect income inequality. Moreover, using supporting policy to encourage entrepreneurship, to reducing inequality could be success in the society that low income, low wealth and relatively uneducated (Kimhi, 2010). This is supported by Quadrini (2000), Meh (2005) and Cagetti and De Nardi (2006) that entrepreneurship leads to wealth concentration due to the higher saving rate of entrepreneurs (Quadrini, 2000).

On the other hand, Rapoport (2002) and Naudé (2008) argued that inequality could encourage entrepreneurship in developing countries. However, the direction of relationship between inequality and entrepreneurship is depending on moderating factors (Meh, 2005). In line with the study of Paulson and Townsend (2004) that the financial constraint plays a key to determine the business start-up and the richer household are easier to start a business. Banerjee and Duflo (2007) emphasize the increasing number of entrepreneurship among the poor by the explanation of characters of the poor with have few skills and little

capital which is difficult for the poor to find a job as an employee but easier to be an entrepreneur. This is supported by the work of Acs, et al (2005), that a country's higher development level can encourage and strengthen entrepreneurial activity. In the work of Deutsch and Silber (2004) by using the Kuznets curve to evaluate the impact of various income sources on inequality which is found that one of the factor that effect to declining section of the Kuznets curve is related to the declining share of entrepreneurial income.

Consequently, we can formulate the following hypothesis:

Hypothesis 1: the higher the level of entrepreneurial behavior in a country, the higher the level of economic development

Hypothesis 2: the higher level of the entrepreneurial behavior in a country, the lower the size of income inequality

Hypothesis 3: the higher level of the entrepreneurial behavior in a country, the lower the size of poverty

Hypothesis 4: the higher the level of the entrepreneurial behavior, the larger the size of the employed population

3. Methodology

To evaluate the relationship of entrepreneurship with poverty, income inequality, employment and economic growth, the researchers followed the method used by Yanya et al. (2013) which incorporated the theoretical model of Beck et al. (2005). To measure the dependent variables, the researchers used the headcount ratio, Gini coefficient, GDP per capita and total labor force; the independent variable were represented by the percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business. In addition, this paper used panel data during the specific points of time from 2012 to 2017 to run a multiple regression. The researchers applied a standard Hausman test to choose between Fixed Effects and Random Effects that would examine the magnitude and the effects of each explanatory variable to the dependent variables.

3.1. Estimation of the Model

List of selected OIC countries are shown in table 1.

Table 1: List of selected OIC countries

Bangladesh, Benin, Cameroon, Chad, Gambia, Mali, Mauritania, Mozambique, Pakistan, Senegal, Sierra Leone, Uganda, Albania, Egypt, , Indonesia, Iran, Jordan, Morocco, Tunisia, Bahrain, Qatar, United Arab Emirates

To evaluate the relationship of entrepreneurship on Economic growth, the researchers regressed the following equation:

$$GDP_{i,t} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} \quad (1)$$

$GDP_{i,t}$: Gross Domestic Product per capita

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model.

To evaluate the relationship of entrepreneurship on employment, the researchers regressed the following equation:

$$LF_{it} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} \quad (2)$$

LF_{it} : Total labor force

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model.

To evaluate the relationship of entrepreneurship on poverty, the researchers regressed the following equation:

$$HCR_{it} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} \quad (3)$$

HCR_{it} : Headcount Ratio

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model

To evaluate the relationship of entrepreneurship on income inequality, the researchers regressed the following equation:

$$GIN_{i,t} = \alpha_0 + \alpha_1 \log(TEA_{it}) + c_1 + u_{it} \quad (4)$$

$GIN_{i,t}$: Gini Coefficient Ratio

TEA_{it} : The percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business

c_1 : The idiosyncratic error with mean 0

u_{it} : The unobserved time constant characteristics of an individual, which is the effect the researchers specifically want to control in the panel data model.

4. Results

Table 2 displays the results of the test of hypotheses 1, 2, 3, 4, that is, the independent effect of entrepreneurship on overall economic performance, that is, the effect of entrepreneurial activity on economic performances of GDP growth, Employment, poverty and income inequality.

Table 2: estimation results for OIC countries

variables	Coef.	Z
Regression 1		
intercept	0.3013	2.47
GDP growth (annual %)	0.4067	3.23
R ²	86%	
Regression 2		
intercept	0.02576	3.22
Employers, total (% of total employment)	0.1145	4.47
R ²	83%	
Regression 3		
intercept	0.11364	2.87
Poverty (headcount ratio)	0.21328	5.45
R ²	78%	
Regression 4		
intercept	0.0024	3.26
Income inequality (Gini coefficient)	0.0276	4.35
R ²	85%	

Source: own calculations

The regression results showed that the entrepreneurship was a significant determinant of the poverty at 1% level of significance. The value for R-squared was 0.78, which meant that 78% of the changes in the headcount ratio could be explained by the changes in the entrepreneurial activities. This was a clear indication that the TEA was a significant determinant of poverty. It also showed that the said variable was negatively related to poverty.

In addition, The regression results showed that entrepreneurship was a significant determinant of the income inequality at 1% level of significance. The value for R-squared was 0.85, which meant that 85% of the changes in the gini coefficient could be explained by the changes in the entrepreneurial activities in OIC countries. This was a clear indication that the TEA was a significant determinant of income inequality. It also showed that the said variable was negatively related to income inequality.

Furthermore, The regression results showed that the Micro, Small and Medium Enterprises was significant determinant of the economic growth at 1% level of significance. The value for R-squared was 0.86, which meant that 86% of the changes in the economic growth could be explained by the changes in the Micro, Small and Medium Enterprises. This was a clear indication that the Micro, Small and Medium Enterprises were significant determinants of the economic growth. The results from the regression analysis showed that there was a negative relationships between entrepreneurship, and poverty and income inequality. It entailed that a percent (1%) increase of TEA accounted to poverty could lead to a decrease of 0.21328 and a decrease of 0.0276 to income inequality. Whereas, the analysis revealed that there was a positive relationship between the entrepreneurship and the economic growth and employment. It meant that a percent (1%) increase of TEA accounted to economic growth could lead to an increase of 0.4067. Moreover, there was a positive relationship between the entrepreneurship and create employment. Hence, a percent (1%) increase of TEA accounted to the increase in employment of 0.1145. The researchers take these results as evidence that entrepreneurship plays a vital role on poverty, income inequality, economic growth and employment in OIC countries.

5. Conclusion

Limited research studies the impact of entrepreneurial activities on economic performance. This study responds to this issue by examining how entrepreneurship affects economic performance. In this regard, the relationship between entrepreneurial activities and economic performances such as poverty reduction, income inequality, employment and economic growth for 22 selected OIC countries from 2012 to 2017. As an empirical matter, the significant support was found for the notion that the firm establishment causes poverty and income inequality decrease, but economic growth and employment increase.

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Health Expenditure, Economic Growth and Life Expectancy at Birth in Resource Rich Developing Countries: A case of Saudi Arabia and Nigeria

Yusuf Opeyemi Akinwale¹

ABSTRACT

Health care has recently been given more attention as disease and various pandemic affect the country's economic productivity. This study investigates the relationship between health expenditure, life expectancy at birth and economic growth in resource rich developing countries namely Saudi Arabia and Nigeria. The study adopts autoregressive distributed lag (ARDL) bound test, error correction model and Granger causality to determine the relationship and the direction of causality among the variables. The results establish that health expenditure and life expectancy positively influenced economic growth in the long run in both countries. While life expectancy has more impact in Saudi Arabia, health expenditure has more impact in Nigeria. Furthermore, the results in the short run reveal that both health expenditure and life expectancy positively influenced economic growth in Saudi Arabia whereas only health expenditure has positive impact on economic growth in Nigeria. The results also indicate one-way causality running from each of the health expenditure and life expectancy to economic growth without any feedback for the two countries. This study confirms a health-led growth hypothesis for both Saudi Arabia and Nigeria. Since health seems to promote economic growth, it becomes imperative for the government of the two countries to further strengthen the health sector with appropriate policy and funding.

ملخص

لقد أُعطيت الرعاية الصحية في الآونة الأخيرة اهتماماً إضافياً بالنظر إلى أن الأمراض ومختلف الأوبئة تؤثر على الإنتاجية الاقتصادية للبلد. وتحقق هذه الدراسة في العلاقة بين الإنفاق على

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الصحة، ومتوسط العمر المتوقع عند الولادة، والنمو الاقتصادي في البلدان النامية الغنية بالموارد، أي المملكة العربية السعودية ونيجيريا. وهي تتبنى الانحدار الذاتي للإبطاء الموزع (ARDL)، ونموذج تصحيح الأخطاء، وسببية غرانجر لتحديد العلاقة واتجاه السببية بين المتغيرات. وثبتت النتائج أن الإنفاق على الصحة ومتوسط العمر المتوقع أثرا إيجابيا على النمو الاقتصادي في الأجل الطويل في كلا البلدين. وفي حين أن متوسط العمر المتوقع له تأثير أكبر في المملكة العربية السعودية، فإن الإنفاق على الصحة عرف تأثيرا أكبر في نيجيريا. وعلاوة على ذلك، تكشف النتائج في الأجل القصير أن الإنفاق على الصحة ومتوسط العمر المتوقع معا أثرا إيجابيا على النمو الاقتصادي في المملكة العربية السعودية في حين أن الإنفاق الصحي وحده هو الذي عرف تأثيرا إيجابيا على النمو الاقتصادي في نيجيريا. وتشير النتائج أيضا إلى أن كل من الإنفاق على الصحة ومتوسط العمر المتوقع يتجهان اتجاها واحدا نحو النمو الاقتصادي دون أي انعكاس بالنسبة للبلدين. وتؤكد هذه الدراسة فرضية نمو تقودها الصحة لكل من المملكة العربية السعودية ونيجيريا. وبما أن الصحة تعزز النمو الاقتصادي على ما يبدو، فإن من الضروري أن تواصل حكومتي البلدين تعزيز قطاع الصحة بسن السياسات وتخصيص التمويل المناسبين.

ABSTRAITE

Les soins de santé ont récemment fait l'objet d'une attention accrue, car les maladies et les diverses pandémies affectent la productivité économique du pays. Cette étude examine la relation entre les dépenses de santé, l'espérance de vie à la naissance et la croissance économique dans les pays en développement riches en ressources, à savoir l'Arabie saoudite et le Nigeria. L'étude adopte le test de liaison ARDL (autoregressive distributed lag), le modèle de correction des erreurs et la causalité de Granger pour déterminer la relation et la direction de la causalité entre les variables. Les résultats établissent que les dépenses de santé et l'espérance de vie influencent positivement la croissance économique à long terme dans les deux pays. Alors que l'espérance de vie a plus d'impact en Arabie Saoudite, les dépenses de santé ont plus d'impact au Nigeria. En outre, les résultats à court terme révèlent que les dépenses de santé et l'espérance de vie influencent positivement la croissance économique en Arabie Saoudite, tandis que seules les dépenses de santé ont un impact positif sur la croissance économique au Nigeria. Les résultats indiquent également une causalité unidirectionnelle allant des dépenses de santé et de l'espérance de vie à la croissance économique sans aucune rétroaction pour les deux pays. Cette étude confirme l'hypothèse d'une croissance tirée par la santé pour l'Arabie Saoudite et le Nigeria. Puisque la santé semble favoriser la croissance économique, il

devient impératif pour le gouvernement des deux pays de renforcer davantage le secteur de la santé par une politique et un financement appropriés.

Keywords: Health expenditure; Life expectancy at birth; Economic growth; Autogressive distributed lag; Saudi Arabia, Nigeria

JEL Classification: C01, H51, I11, O11, P46

1. Introduction

The economic growth and development in both developed and developing economies have been attributed in somewhat to human capital development in many previous studies. Health care access, quality and delivery occupies a nucleus position in achieving Sustainable Development Goals (SDG) which is an offshoot of Millennium Development Goals (MDGs). Most of the countries that have invested substantially in human capital have been reported to have reaped the benefits of a sustainable economic development (Akinwale, 2018). The endogenous growth theory has highlighted a significant part played by human capital accumulation to productivity and long-term economic growth (Lucas 1988; Romer 1990). The world is transforming from a resource-based economy to knowledge- and skill-based economy. This transformation gives credence to the role human capital is playing to achieve this transition. Education and health are the major elements of human capital development of any society. While education as a measurement of human capital towards economic development has been generally explored in the past studies, there are limited scientific studies which have examined health in measuring human capital towards GDP growth. The Covid-19 pandemic which created serious economic turbulent across the world has shown the importance of health in economic growth (Akinwale, 2020).

Assessing the linkages between economic growth and health in the resource rich countries becomes important as a skilled and healthy individual is expected to do his/her job much better than a skilled but unhealthy individual. This signifies that education could be a necessary condition of human capital development but not a sufficient condition as health is crucial to the wellbeing of any workforce which engenders productivity. A healthy individual can effectively acquire the requisite

skills and knowledge because good health status improves the stock of human capital which is needed to achieve higher income and sustainable growth (Boachie, 2017; Barro 1999).

Expenditure on health care has been posited by Mushkin's health-led growth hypothesis to ignite economic growth, as the study categorised health as a capital which could be accumulated through investment, and this investment can improve the quality of workers' life, improve life expectancy at birth, ameliorate morbidity rate as well as increase labours' productivity (Bedir, 2016; Elmi and Sadeghi, 2012; Murthy and Okunade, 2009; Mushkin, 1962). In another study conducted by Bloom, Kuhn and Prettnner (2018) from the World Bank data obtained, using the Preston curve framework (Preston, 1975) confirms the assertions that countries with higher incomes tend to have better health status than countries with lower incomes. This is also confirmed in few related studies (Weil, 2015, 2014; Deaton, 2013). The effect of health care expenditure has varying results for both high- and low-income countries (Dhrifi, 2018). It would be interesting to explore the resource rich developing economy as well in order to find out if there exists the link between economic growth and health as well as the nature of causal direction between them.

The studies on health care and economic growth are limited as most studies considered mainly education to be associated with human capital. This makes understanding of the association between GDP and health to be somewhat incomplete. Furthermore, the results of the few related studies on health and economic growth are mixed and inconclusive. While there are studies that show positive association (Boachie, 2017) between the two variables, others reveal negative association. More so, the results of some studies show different causal direction as some studies show one-way causality from health to GDP growth (Bloom and Fink, 2014), some other studies show the reverse (Ogunjimi and Adebayo, 2019); whereas few studies show bidirectional causality and no causality. While few related studies have been conducted among OECD, the evidence of this related study from resource rich developing economies is scanty or not available. Hence, the purpose of this paper is to investigate the association between economic growth and health in resource rich developing economies focusing on Saudi Arabia and Nigeria as they are both members of organization of petroleum exporting countries (OPEC). Furthermore, the two countries have recently came up with various strategies and visions to diversify their economies from crude oil. The

remaining sections of this paper are divided as follows; section 2 presents the literature review and empirical studies on health and economic growth, section 3, 4 and 5 presents the methodology for the study, results analysis, and conclusion respectively.

2. Literature Review

This section discusses the overview of health and life expectancy at birth as well as the empirical literature of the study.

2.1 Overview of Health and Life Expectancy at birth in Resource rich Countries: A Case of Saudi Arabia and Nigeria

This study refers resource rich economies as those countries that have been blessed with the natural resources such as crude oil, natural gas, gold and other solid minerals among others. These countries are expected to be richer than other countries because of their resource base. Though a few of these countries have been able to increase their national income and GDP through these natural resources but many of them are still underdeveloped. This could be due to what is termed resource curse which among other factors arise as a result of abandoning other sectors of the economy to solely rely on a single resource. Saudi Arabia and Nigeria are richly endowed with crude oil of the total estimated proved reserves of 297.7 thousand million barrels and 66.4 thousand million barrels respectively (BP Statistical Review, 2019). The contribution of oil sector to foreign exchange earnings of Saudi and Nigeria are 70% and 90% respectively, while the oil sector contribution to GDP is 50% and 10% for Saudi and Nigeria respectively (General Authority of Statistics, 2019; Adelowo et al., 2016). The two countries have embarked on the economy diversification path so as to reduce their dependence on oil. The fluctuation of global oil price has significantly impaired the economic growth-path of the two economies anytime there is a downward trend in the global crude oil price which for instance led to economic recession especially in Nigeria in year 2016/2017 and year 2020/2021 during Covid-19 pandemic. This diversification path has led to the creation of Vision 2030 in Saudi Arabia therein consists of various goals and strategies of driving the economy towards growth and reducing the reliance on oil. Improvement in the health sector has been recognized as one of the ways to achieve sustainable growth.

The snap glance of health expenditure in Saudi Arabia and Nigeria is shown in Table 1 below. The current health expenditure as a percentage of GDP is 4.2%, 3.7% and 5.7% for Saudi Arabia while 2.6%, 3.3% and 3.7% for Nigeria for the year 2000, 2010 and 2016 respectively. This shows that Saudi Arabia is spending an average of 4.5% on health (as % of GDP) based on the three years mentioned and Nigeria spends an average of 3.2% on health (as % of GDP). The domestic government of Saudi Arabia spends 67.8% of the total current health expenditure of year 2016 whereas the Nigerian government spends 13% of the total current health expenditure for the year 2016.

Table 1: Life Expectancy and Health Expenditure in Saudi Arabia and Nigeria

Year	Current HE (% of GDP) for Saudi	Current HE (% of GDP) for Nigeria	Domestic Government HE (% of current HE) for Saudi	Domestic Government HE (% of current HE) for Nigeria	Life Expectancy for Saudi (in years)	Life Expectancy for Nigeria (in years)
2000	4.21	2.64	72.05	20.12	72.6	43.3
2010	3.66	3.26	64.85	13.76	73.9	50.9
2016	5.74	3.65	67.80	13.02	74.8	53.5

HE: Health Expenditure

Source: World Bank Development Indicators, 2019

This indicates that government is mainly provider for health care and health spending in Saudi Arabia whereas domestic private individuals and companies are primary providers of health service and health spending in Nigeria. The average life expectancy at birth in Saudi Arabia is above 70 years while that of Nigeria is approximately 50 years as shown in Table 1. The domestic government spending on health (as a ratio of the total expenditure) ranges between 7% and 10% for Saudi Arabia over the period 2000-2016 whereas that of Nigeria ranges between 2% and 5%. The figure of current health spending per capita (in current US\$) is over US\$1000 for Saudi individual in year 2016 while this figure is less than US\$100 for Nigeria individual in the same year. This could be due to the high population in Nigeria in one hand, but on the other hand it revealed that an average individual in Nigeria has less income to spend on health care. The content analysis of Table 1 indicated that Saudi Arabia fared

better than Nigeria in the health indices presented despite that they are both resource rich countries.

2.2 Empirical Literature

This research is situated within the augmented neo-classical economic growth theory (Mankiw et al., 1992) and endogenous growth theory (Romer, 1990; Lucas, 1988). It is believed that human capital is a vital factor which promotes the increase of aggregate output in the economy. Human capital, specifically health and education, is being viewed as a separate factor of productivity and growth for the past three decades (Bedir, 2016). Improvement in health is very significant to increase labor productivity and capital accumulation. According to Mushkin's (1962) health-led growth hypothesis, health care spending (investment) has been suggested to increase income and stimulate the aggregate economic output. Meanwhile, Preston (1975) is of the view that country with higher incomes seem to have a better health conditions for her citizens and residents than the country with lower incomes. Hence, two-way causality can be analyzed between economic growth (income) and health.

Ozturk and Ada (2013) studied the link between GDP and health spending among the European Union (EU) members which consists of Portugal, Greece, Spain, Austria, Belgium, Luxembourg, Denmark, France and Italy over the period 1980—2009. The result of cointegration revealed that economic growth and health spending have long run relation in 6 out of 9 Countries. More so, the result of granger causality is mixed in the sampled countries. Economic growth granger cause health expenditure in Spain, Luxembourg, Portugal, Austria, France and Italy; there is bidirectional causality in the case of Belgium; whereas no causal connection was found between health spending and GDP in Denmark and Greece. While Hassan and Kalim (2012) could not detect a short run causality between health spending per capital and real GDP per capital in Pakistan, but a bidirectional causality was established between them in the long term.

Boachie (2017) investigated the influence of health on GDP in Ghana using ARDL bounds test for the period 1982-2012 whereby GDP per capita and life expectancy measure economic growth and health respectively. The result disclosed that good health positively and significantly fosters GDP at both short- and long-run.

Bedir (2016) assessed the connection between income and health expenditures in some selected developing countries in Asia, Middle East African and Europe for the period 1995-2013. The results on one hand revealed a one-way causality from health to income for South Africa, Egypt, Korean Republic, Hungary, and the Philippines. On the other hand, the results also revealed causality from income to health for China, Greece and UAE among others. Meanwhile two-way causality was also found for Russia and Czech Republic. Ogunjimi and Adebayo (2019) assessed the nexus among GDP, health outcomes and health expenditure in Nigeria between 1981 and 2017 using Toda-Yamamoto Causality and ARDL bound statistical test. The outcomes showed a one-way causality from health spending to infant mortality; a unidirectional causality from GDP and health spending to life expectancy and maternal mortality was found; and a causality from GDP to health expenditure was also established.

Bhargava et al. (2001) examined the impacts of adult survival rates (ASR) on economic growth. The results indicated positive impacts of ASR on GDP growth rates in low-income nations whereas the estimated impact was negative for highly developed countries. Wang (2015) using GMM estimated the optimal health care spending among the OECD between 1990 and 2009. The outcome of the study disclosed that when the percentage of health expenditure to GDP is below the optimum level of 7.55 per cent, increases in health expenditure effectively resulted in an improved economic productivity, whereas health expenditure beyond this level would not improve health care service.

Bloom et al. (2004) revealed that good health positively influences economic growth using a production model. Aboubacar and Xu (2017) studied the nexus between health care expenditure and GDP in Sub-Saharan Africa between 1995 and 2014 using GMM. The outcome indicated that health spending significantly influenced GDP of the region. Boussalem et al. (2014) in their study between GDP and public health expenditure in Algeria found causality from health spending to GDP in the long run. However, the result revealed a one-way direction from GDP to health expenditure in the short run. Wang (2011) used panel of 31 countries between 1986 and 2007 to analyse the nexus between GDP and health spending. The results of the panel regression showed that health spending accelerate GDP growth whereas the GDP growth decreases health spending growth. The quantile regression reported that health expenditure tends to increase economic growth in middle- and high-

income countries but tend to decrease GDP in low-income nations. In the study of Eggoh et al. (2015) which explored the association between GDP and human capital for the period 1996-2010 in 49 African countries. The result reported that health expenditures negatively influenced economic growth, which was attributed to underinvestment in health sector, bureaucracy and corruption in many African countries.

Ercelik (2018) using autoregressive distributed lag (ARDL) examined the association between output and health spending in Turkey between 1980 and 2015. The result indicated a positive long run association between output and health care spending. Also, Pradhan (2010) explored the impact of health expenditure on GDP in 11 nations, which comprises countries from Europe, Asia and North America for the period 1961-2007. The outcome of the panel framework indicated a two-way direction between health expenditure and GDP.

The empirical results have indicated that while some studies have showed health variables such as expenditure, adult survival rate, and life expectancy among others as significant contributors to economic growth in some countries, other studies showed that economic growth is the main contributor to health variables. Furthermore, there are studies that showed bi-directional association between health and economic growth and few others was not able to find any association between them. The past studies have been conducted among EU members, Asian countries, Sub-Saharan Africa and other few countries with no study among the resource rich countries. Hence, this article assesses the association between health factors and GDP in resource rich countries with the case study of Saudi Arabia and Nigeria.

3. Methodology

This section covers the variables, data and the method used for this study.

3.1. Variables, Measurement and Data Sources

This study used time series data which span between 2000 and 2016 for Saudi Arabia and Nigeria. The data of concern include health expenditure per capita, life expectancy at birth and GDP per capital. Current health expenditures per capita in current US dollars measure the total estimated healthcare goods and services consumed by each individual within a year in a country. Life expectancy at birth measures how long (in years) a newborn baby would live given the present health condition in such a country, and assuming the condition is constant throughout his/her life period.

Health expenditure per capital (HEC) and life expectancy at birth (LEB) are the variables which are used to proxy health, while GDP per capita (Constant at 2010 US\$) is used to proxy economic growth (GDPC) and were obtained from World Bank data bank. Unlike most studies which used either health expenditure or life expectancy, this study used the two variables together to capture health. The period of the sample used for this study was based on the constraints on the availability of data on World Bank Development Indicator data bank.

3.2. Model Specification

This study is premised on the economic growth model wherein health (proxied by health expenditure and life expectancy at birth) is a major factor contributing to economic growth (GDP per capita) as shown in Eqn. (1)

$$GDPC = f(HEC, LEB) \quad (1)$$

Natural logarithm is introduced to the growth model stated above to eliminate the stochastic error term from the model, then the log linear form for Eqn. (1) is expressed in Eqn (2) as:

$$LGDPC = B_0 + B_1LHEC + B_2LLEB + U_t \quad (2)$$

Where B_0 is the constant term; B_1 and B_2 are the coefficients of LHEC and LLEB respectively; and U_t is the error term.

It therefore becomes imperative to test for a unit root on the data to obtain the data that are stationary so as to prevent the model from spurious results. A variable is adjudged stationary when the mean, variance and

autocovariance are constant for each given lag (Brooks, 2008). A unit root test is carried out in this study using the Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1979). The existence of a unit root implies nonstationary of the data and denoted as null hypothesis, whereas nonexistence of a unit root is indicated by the alternative hypothesis. If the null hypothesis of the ADF test could not be rejected, that depicts that the variable is not stationary, which then leads to the removal of the unit root by differencing the data by d times in order to make it stationary i.e $I(d)$. It is expected that the variables that would be used for the model could be stationary at level $I(0)$ or at *first difference* $I(1)$. If a variable is stationary at *second difference* $I(2)$, such variable would be dropped in order to avoid spurious result. When the data comprises $I(0)$ and $I(1)$ variables, then the autoregressive distributed lag (ARDL) could be adopted (Pesaran and Shin, 1998). This method has the capacity to estimate relationship better than other methods when the variables are cointegrated of different order and when the size of the sample is relatively small.

ARDL is a method which assesses the links between two or more variables in both long- and short-term (Pesaran et al., 2001). This is tested using the ARDL Bounds test of cointegration as stated in Eqn. (3) below.

$$\Delta LGDPC_t = \alpha_0 + \sum_{j=0}^n \gamma_j \Delta LGDPC_{t-j} + \sum_{j=0}^n \beta_j \Delta LHEC_{t-j} + \sum_{j=0}^n \theta_j \Delta LLEB_{t-j} + \varphi_1 LGDPC_{t-1} + \varphi_2 LHEC_{t-1} + \varphi_3 LLEB_{t-1} + \varepsilon_t \quad (3)$$

From Eqn. (3) above, the changes in the natural log of each of the variables at time t are represented by $\Delta LGDPC_t$, $\Delta LHEC_t$, and $\Delta LLEB_t$. Furthermore, the constant value, number of lags and the error term are represented by α_0 , n and ε_t respectively. While $\Delta LGDPC_t$ is the dependent variable, $\Delta LHEC_t$ and $\Delta LLEB_t$ are the independent variables. The short run parameters are represented by the coefficients β_j , γ_j , θ_j whereas the long run parameters which indicate the existence of cointegration through bound test are depicted by φ_1 , φ_2 and φ_3 . The null and alternative hypotheses are stated below as derived from Eqn. (3). The null hypothesis signifies that there is no cointegration between the variables, while the alternative hypothesis indicates the presence of cointegration.

$$H_0: \varphi_1 = \varphi_2 = \varphi_3 = 0$$

$$H_1: \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq 0$$

According to Pesaran et al. (2001), if the calculated value of the F-statistic is above the upper bounds of the critical value, then the existence of cointegration is established through the rejection of null hypothesis. However, if the calculated F-statistic is below the lower bounds of the critical value, then there is absence of cointegration among them. Meanwhile when the value of the F-statistic is in between the upper bound and the lower bound of the critical values, then this implies inconclusive result. Once the model established the existence of cointegration, then the long run coefficients and effects of the independent variables can be obtained after estimating a long run growth model of Eqn. (4).

$$LGDPC_t = \alpha_0 + \varphi_1 LGDPC_{t-1} + \varphi_2 LHEC_{t-1} + \varphi_3 LLEB_{t-1} + \varepsilon_t \quad (4)$$

This indicates that error correction model within ARDL framework could be performed (Akinwale and Muzindutsi, 2019). The coefficients β_j , γ_j , θ_j of each explanatory variables explained the short run causality (Narayan and Smyth, 2009; Altaee et al., 2016; Akinwale and Grobler, 2019). This is expressed in Eqn. (5) as follows:

$$\Delta LGDPC_t = \alpha_0 + \sum_{j=0}^n \gamma_j \Delta LGDPC_{t-j} + \sum_{j=0}^n \beta_j \Delta LHEC_{t-j} + \sum_{j=0}^n \theta_j \Delta LLEB_{t-j} + \lambda ECT_{t-1} + \varepsilon_t \quad (5)$$

The coefficient of ECT_{t-1} is represented by λ and this indicates the adjustment coefficient, which should be negatively significant in order to confirm the cointegration relationship and the long run speed of adjustment.

4. Discussion of Results

Table 2 describes the natural log of the three series. The mean values of the three series are higher for Saudi Arabia than that of Nigeria. However, the standard deviation values for the three series are higher for Nigeria than that of Saudi Arabia. This shows that Saudi Arabia performs better in the three index and also less volatile, though the levels of volatility in the two countries are generally low. The probability values of Jarque-Bera

test are greater than 5% which signify that the three variables are normally distributed in both countries.

Table 2: Descriptive statistics

Item	Saudi Arabia			Nigeria		
	LGDP	LHEC	LLEB	LGDP	LHEC	LLEB
Mean	9.8759	6.4777	4.2966	7.5926	3.9813	3.9073
Maximum	9.9762	7.1584	4.3143	7.8490	4.6749	3.9804
Minimum	9.7183	5.9075	4.2844	7.1601	2.6825	3.8344
Std. Dev.	0.0750	0.4574	0.0094	0.2472	0.6787	0.0486
Jarque-Bera	0.6544	1.5343	1.0410	2.2195	2.5908	1.6680
Probabiliy	0.7209	0.4643	0.5942	0.3296	0.2330	0.5311

The ADF results in Panel(A) for Saudi Arabia show that the log of economic growth and health expenditure are stationary at I(1) while log of life expectancy at birth is stationary at I(0) as reflected in Table 3. More so, in Panel(B) for Nigeria, log of health expenditure is stationary at I(1) while that of life expectancy and economic growth are stationary at I(0). The series for the two countries do not contain any data that is stationary at I(2), and the series consist of both I(0) and I(1). This indicates the absence of unit root in the series and at the same time make the data suitable for ARDL Bounds test.

Table 3: ADF test for unit root

Series	Panel A (Saudi Arabia)		Remark	Panel B (Nigeria)		Remark
	Levels	First Difference		Levels	First Difference	
LGDP	-0.73	-3.73**	I(1)	-9.25***	-3.19**	I(0)
LHEC	-0.22	-3.90**	I(1)	-2.22	-3.34**	I(1)
LLEB	-4.42***	-8.32***	I(0)	-4.25***	-0.01	I(0)

(*), (**), (***) denote 10%, 5%, 1% and significant level, respectively

Eqn. (3) was conducted to establish the presence of cointegration between LGDP and the exogenous variables (LHEC and LLEB) using ARDL. The results as shown in Table 4 reveal the rejection of null hypothesis at

5% level for both countries as the computed F-statistic is above the upper boundaries. While the calculated F-statistic is 5.07 as against the upper bound critical value of 4.85 for Saudi Arabia, the calculated F-statistic is 16.64 in the case of Nigeria. This implied a long run association among the variables in both countries.

Table 4: Bounds test for F-statistic

Country	K	F-statistic	5% Level of Significance	
			Lower Bound	Upper Bound
Saudi Arabia	2	5.07	3.79	4.85
Nigeria	2	16.64	3.79	4.85

Table 5 shows the long run coefficients and impact among the variables as derived from Eqn. (4). The results indicate that both health factors (LHEC and LLEB) have positive influence on economic growth in both Saudi Arabia and Nigeria in the long run. In Saudi Arabia, health expenditure and life expectancy positively influence economic growth by 0.15 and 12.35 respectively, whereas health expenditure and life expectancy at birth positively influenced GDP by 0.30 and 0.29 respectively in Nigeria. This implied that 1% rise in health expenditure and life expectancy in the long run would raise economic growth by 0.15% and 12.35% respectively in Saudi Arabia but would raise economic growth by 0.30% and 0.29% in Nigeria. Furthermore, while life expectancy is significant at 1% level in Saudi Arabia, health expenditure is significant at 1% level in Nigeria.

Table 5: Estimated Long run Coefficients using ARDL

Variables	Coefficient (Saudi Arabia)	Coefficient (Nigeria)
LHEC	0.15	0.30***
LLEB	12.35***	0.29

(*), (**), (***) indicate 10%, 5% and 1% significant level, respectively

After the long run relationship has been established, it becomes necessary to study the short run dynamics as well as the long-term speed of adjustment of the error correction model as stated in Eqn. 5. Table 6 reports that in the short term, LLEB and LHEC positively influenced LGDPC by 2.43 and 0.07 respectively in Saudi Arabia though only LLEB

is statistically significant. The ECT is in line with the expectations. The coefficient value of -0.71 indicates that 71% of any shock from equilibrium is corrected each year which means the speed of adjustment back to equilibrium is relatively fast. Also, Table 6 reveals that while LHEC has a positive and significant effect on LGDPC in Nigeria with 0.31 coefficient value in the short run, LLEB has a negative and insignificant influence on LGDPC with a value of -2.98. The ECT is negatively significant at 1%, and the value of -0.72 implies that any deviation from the long run equilibrium would automatic adjust back with a speed of 72%.

Table 6: Short run Coefficients using ECM

Variables	Coefficient (Saudi Arabia)	Coefficient (Nigeria)
Δ LHEC (-1)	0.07	0.31***
Δ LLEB (-1)	2.43**	-2.98
ECT(-1)	-0.71***	-0.72***

(*), (**), (***) indicate 10%, 5% and 1% significant level, respectively

The causal analysis between the variables was also conducted using Granger (1969) causality test. Table 7 shows a one-way causality from LHEC and LLEB at birth to LGDPC for Saudi Arabia, and from LLEB to LHEC. On the other hand, there is only one-way causality from LLEB and LHEC to LGDPC in Nigeria without any other form of causality. These results confirmed health-led growth hypothesis for the two countries since there is no causality from LGDPC to either LHEC or LLEB.

Table 7: Granger Causality Results

Null Hypothesis:	F-Statistic (Saudi)	F-Statistic (Nigeria)
Δ LHEC does not Cause Δ LGDPC	3.32*	12.79***
Δ LGDPC does not Cause Δ LHEC	1.18	0.13
Δ LLEB does not Cause Δ LGDPC	10.79***	4.02*
Δ LGDPC does not Cause Δ LLEB	0.19	1.70
Δ LLEB) does not Cause Δ LHEC	4.23**	2.65
Δ LHEC does not Cause Δ LLEB	0.28	1.83

(*), (**), (***) denote 10%, 5% and 1% significant level, respectively

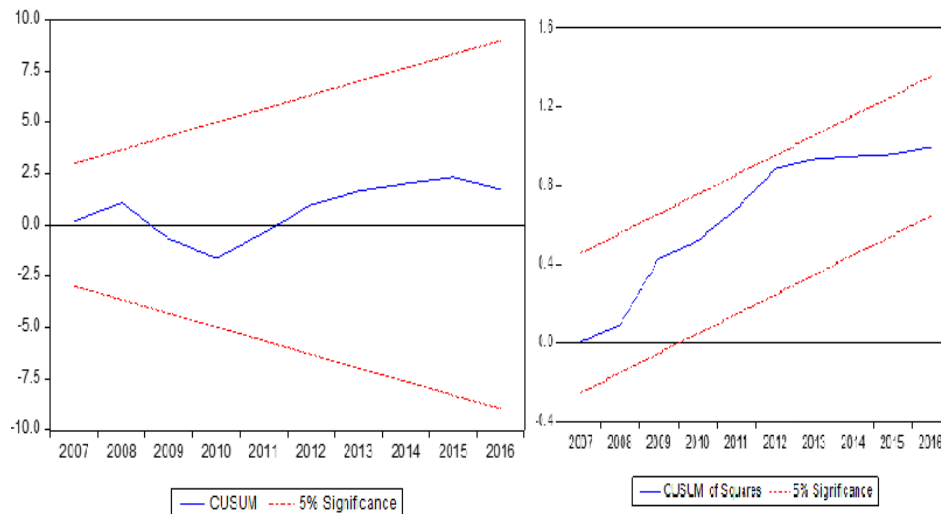
The results from this study have shown that both health expenditure and life expectancy positively influence economic growth of the two resource rich countries. These results are in line with some related studies (Boachie, 2017; Aboubacar and Xu, 2017; Schultz, 2005; Gyimah-Brempong and Wilson, 2004) but different from other studies (Eggoh et al., 2015). The life expectancy seems to have much impact in Saudi Arabia which could not be farfetched from the longer number of years people live. As people live longer, they tend to contribute more to the economic growth of Saudi Arabia. Socioeconomic and human development factors which contribute to life expectancy are not discussed in this study. Health expenditure has more influence on economic growth than life expectancy in Nigeria. Nigeria has increased the spending on health care so as to meet the target of Abuja Declaration of 2001 which is allocation of a minimum of 15 per cent of their yearly budget to advance the health sector. However, the life expectancy in Nigeria is relatively lower than the world's average (World Bank Development Indicator, 2019), which is ordinarily affecting the GDP in the short run as the average life expectancy of people in the country is 54 years. There is a need for the country to improve the socioeconomic infrastructure and human development which would invariably improve life expectancy. The results of the long run growth model are further supported by the Granger Causality test, which reveal that causality runs from each of health expenditure and life expectancy at birth to economic growth without any feedback, which is against the results obtained by few studies (Ogunjimi and Adebayo, 2019; Erçelik, 2018; Halıcı-Tülüçe et al., 2016) but similar to few other studies (Bedir, 2016; Ozturk and Topçu (2014). There is a great need for the government to continue to invest in health care human and infrastructural development so as to boost the productivity of the residents of the two countries which would improve the economic growth.

The residual and stability diagnostic tests were also conducted to determine the adequacy of the data used for this study. The results of the test for autocorrelation, heteroskedasticity and normality are stated in Table 8. The results reveal that the model passed all the diagnostic tests as the null hypotheses of no serial correlation, no heteroskedasticity and normal residuals could not be rejected as their probability values are above 5% level of significant for the two countries.

Table 8: Diagnostic test results

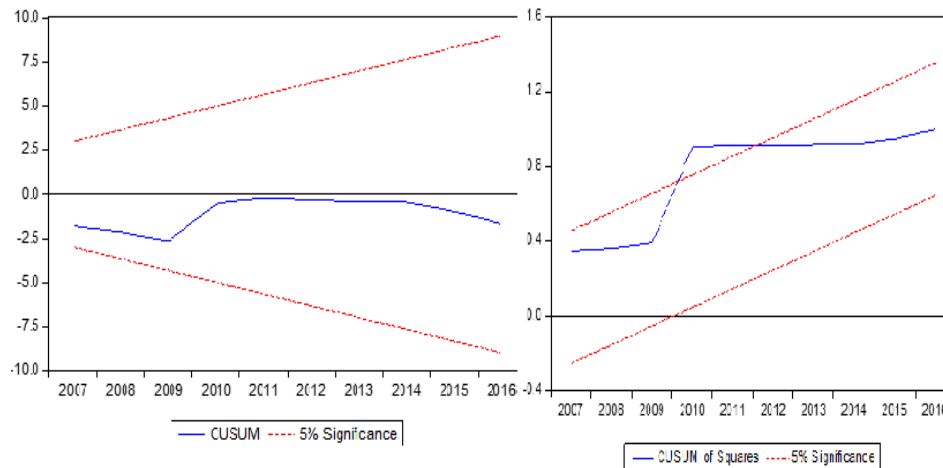
Item	Statistic	P-Val (Saudi)	P-Val (Nigeria)
Serial Correlation	LM Test	0.58	0.66
Normality	JarqueBera	0.86	0.69
Heteroscedasticity	Breusch Pagan Godfrey	0.82	0.50

Also, the results of stability tests are represented by the graphs of CUSUM and CUSUM sum of squares (CUSUMsq), and they are expected to be within the boundary of 5% level of significance. Figure 1 shows that both the CUSUM and CUSUMsq are within the two limits for Saudi Arabia, which represent that the model is structural stable over the long run period observed.

Figure 1: Stability test of CUSUM and CUSUMsq for Saudi Arabia

Furthermore, While CUSUM test shows stability of the model in Figure 2 in the case of Nigeria as the graph is in between the two boundaries at 5% level, the CUSUMsq shows that the graph slightly goes out of the boundary of 5% level between year 2010 and 2011 and this could be an outcome of financial meltdown towards the end of 2009 which affected most sectors of the economy. However, the model is adjudged adequate as it passed the residual and stability diagnostic tests.

Figure 2: Stability test of CUSUM and CUSUMsq for Nigeria



5. Conclusion

This study explored the linkages between economic growth, life expectancy at birth and health expenditure in Saudi Arabia and Nigeria. The research utilized the ARDL, ECM and granger causality to assess the long run, short run and causal relationships among the variables. The results of bounds test indicate a cointegration among the variables which signified the existence of long run relationship in both countries. In the long run, health expenditure and life expectancy at birth positively influence economic growth in both countries. Although, life expectancy at birth has higher impact than health expenditure in Saudi whereas health expenditure has higher impact in Nigeria. The results of the two countries in the short run are also similar to that of the long run except that life expectancy at birth negatively affected economic growth in Nigeria. The causality test showed a one-way causality running from each of health expenditure and life expectancy at birth to economic growth. This study hereby validates health-led growth hypothesis in the resource rich countries of Saudi Arabia and Nigeria.

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Electricity Consumption and Economic Growth in D8 Countries: Bootstrap Panel Causality

Şerif CANBAY¹

ABSTRACT

This study aims to test whether there is any relationship between the electricity consumption and gross domestic product of D8 countries (Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Turkey) and in the period of 1971 and 2014. The relationships between variables are examined through the Bootstrap Panel Causality test. The most important reason for choosing this test is that it reveals individual causality relationships for each country and that there is no need for unit root and/or cointegration testing prior to it. According to the Bootstrap Panel Causality test results, there is a positive and unidirectional causality relationship from electricity consumption to economic growth (the growth hypothesis) in Iran and from economic growth to electricity consumption in Indonesia and Nigeria (the conservation hypothesis). For Egypt and Malaysia, a positive and bidirectional causality relationship (the feedback hypothesis) is determined between the variables, while no causality (the neutrality hypothesis) relationship is found between the variables in Bangladesh, Pakistan, and Turkey.

ملخص

تهدف هذه الدراسة إلى اختبار ما إذا كانت هناك أي علاقة بين استهلاك الكهرباء والناتج المحلي الإجمالي للدول الثماني الإسلامية النامية D8 (إندونيسيا وإيران وباكستان وبنغلاديش وتركيا وماليزيا ومصر ونيجيريا) وفي الفترة ما بين 1971 و 2014. ويتم فحص العلاقات بين المتغيرات من خلال اختبار السببية التمهيدي. ويتمثل أهم سبب لاختيار هذا الاختبار في كونه يكشف عن علاقات سببية فردية لكل بلد وعدم الحاجة إلى إجراء اختبار جذر الوحدة و/أو الاندماج المشترك قبله. وطبقا لنتائج اختبار

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السببية التمهيدي، فهناك علاقة سببية إيجابية أحادية الاتجاه من استهلاك الكهرباء إلى النمو الاقتصادي (فرضية النمو) في إيران ومن النمو الاقتصادي إلى استهلاك الكهرباء في إندونيسيا ونيجيريا (فرضية الحفاظ على الطاقة). وبالنسبة لمصر وماليزيا، فإن العلاقة السببية الإيجابية ذات الاتجاه الثنائي (فرضية التغذية المرتدة) تتحدد بين المتغيرات، في حين لا توجد علاقة سببية (فرضية الحياد) بين المتغيرات في كل من بنغلاديش وباكستان وتركيا.

ABSTRAITE

Cette étude a pour but de tester s'il existe une relation entre la consommation d'électricité et le produit intérieur brut des pays du D8 (Bangladesh, Egypte, Indonésie, Iran, Malaisie, Nigéria, Pakistan, et Turquie) et dans la période de 1971 à 2014. Les relations entre les variables sont examinées par le test de causalité Bootstrap Panel. La raison la plus importante du choix de ce test est qu'il révèle des relations de causalité individuelles pour chaque pays et qu'il n'est pas nécessaire d'effectuer au préalable des tests de racine unitaire et/ou de cointégration. Selon les résultats du test de causalité Bootstrap Panel, il existe une relation de causalité positive et unidirectionnelle entre la consommation d'électricité et la croissance économique (hypothèse de croissance) en Iran et entre la croissance économique et la consommation d'électricité en Indonésie et au Nigeria (hypothèse de conservation). Pour l'Égypte et la Malaisie, une relation de causalité positive et bidirectionnelle (l'hypothèse de rétroaction) est déterminée entre les variables, tandis qu'aucune relation de causalité (l'hypothèse de neutralité) n'est trouvée entre les variables au Bangladesh, au Pakistan et en Turquie.

Keywords: Economic Growth, Electricity Consumption, Bootstrap Panel Causality, D8 Countries

JEL Classification: O10, Q40, C33

1. Introduction

Since the Industrial Revolution in which economics emerged as a branch of science, it is unlikely that industrialization, production, and economic growth can function without consuming energy. Energy, which accelerated the Industrial Revolution, was an important input for economic growth and a vital factor of production for economic growth (Ebohon, 1996).

The stagflation phenomenon experienced throughout the world with the oil crisis of 1973 once again demonstrated the importance of energy and

its effects on economic growth. Restricting oil production by Middle Eastern oil-producing countries during this oil crisis has raised prices fourfold in a short time and left deep scars on the economies of industrialized countries. Especially with this crisis, there has been a significant increase in the number of studies examining the relations between energy consumption and economic growth. The basic need for energy for economic growth stems from the need for this input at almost every stage of the production process.

In the production processes, besides energy sources such as natural gas, oil, nuclear energy, and renewable energy, electricity has a special place in terms of being more widely used. The findings of studies investigating the relationships between electricity consumption and economic growth reveal four different results. These results are classified as the conservation, growth, feedback, and neutrality hypothesis. The conservation hypothesis is the existence of a causality relationship from economic growth to energy consumption. This hypothesis is based on the view that policies to prevent energy consumption and waste will not have negative effects on economic growth. In other words, reducing energy consumption does not prevent economic growth. The conservation hypothesis is supported if real output increases in the economy lead to an increase in energy consumption. Economic growth may slow due to political instability or a lack of good management of resources and reduced demand for goods and services, including energy consumption. In such a case, energy consumption is also negatively affected. Accordingly, policies aimed at reducing energy consumption or losses will have limited or no impact on economic growth. Such economies are economies with little energy dependence. The growth hypothesis is a finding of causality relationship from energy consumption to economic growth. In this hypothesis, energy consumption affects economic growth as a complement to labour and capital in the production process. According to this hypothesis, while electricity consumption has a positive effect on economic growth, decreases in electricity consumption have a negative effect on economic growth. The feedback hypothesis, which is another hypothesis in the literature, reveals the findings that there is a bidirectional causality relationship between the variables. In this hypothesis, energy consumption and real output interact with each other, but also have the characteristics of completing each other. In such a case, policies aimed at increasing efficiency in energy consumption do not have negative effects on economic growth. Lastly, the neutrality hypothesis

indicates that there is no causality relationship between the variables. This hypothesis is based on the argument that electricity consumption is not a very important input for total output. The neutrality hypothesis does not have a positive or negative effect on the real output of energy-saving policies (Squalli, 2007: 1193; Payne, 2010: 723).

In this study, the relationship between the gross domestic product and electricity consumption of D8 countries (Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Turkey) between 1971 and 2014 is investigated by the Kónya (2006) bootstrap panel causality test. The D8 organization formed within the framework of economic and commercial cooperation of 8 developing Muslim countries was brought to the agenda during a seminar called “Cooperation in Development” held in Istanbul in 1996. D8 was officially established by a declaration signed in Istanbul on 15 December 1997 under the leadership of Necmettin Erbakan, prime minister of the 54th Government of the Republic of Turkey (Razzaqi, 2011:437). One of the main reasons why D8 countries are included in the model in this study is that all of these countries are homogeneous within the group of developing countries, that is, at levels of development. In addition, although they have a homogeneous structure at levels of development, the fact that some of the countries in this group of countries are energy-dependent and some are energy importers attributes particular importance to this study. In this respect, the findings that will be obtained after the analysis chapter of the study will also reveal the functionality of the hypotheses in theory about electricity consumption and economic growth. At the same time, the Kónya (2006) bootstrap panel causality test applied in the study is also important both for this subject and for this group of countries in terms of being the first study in the literature.

The research first reviews in depth previous empirical studies on the subject. After the review of the literature, data on economic growth and electricity consumption variables of the countries subject to analysis are introduced. Following the introduction of the data, information is given about the method of the Kónya (2006) bootstrap panel causality test used for analysis. After the methodology chapter, the findings are discussed. In the conclusion chapter, the findings are analyzed in detail, and economic and political inferences are suggested.

2. Literature Review

Energy consumption has been a vital factor in production for economic growth since the Industrial Revolution. The stagflation phenomenon experienced throughout the world, especially with the oil crisis of 1973, once again demonstrated the importance of energy and its effects on economic growth, and with this process, a significant increase was seen in the number of studies examining the relationships between energy consumption and economic growth. In the production processes, besides energy sources such as natural gas, oil, nuclear energy, and renewable energy, electricity has a special place in terms of being more widely used. In this context, studies on the economic growth of electricity consumption, which is one of the main inputs of production, also have a distinct frequency. It is observed that real GDP or GDP per capita variables represent economic growth in most of the studies conducted in this regard. Therefore, the concepts of electricity consumption and economic growth are used in the studies to be discussed in the literature review.

The first study to be examined in the literature review is Razzaqi's (2011) study; the only one carried out for D8 countries. Three main factors distinguish the study of Razzaqi (2011) from this study. The first of these is the period discussed, the second is the methodology, and the third is the variable of energy consumption rather than electricity consumption. The researcher studies the relationships between energy consumption and economic growth in 1980-2007 with VAR Granger causality test and Vector Error Correction Model (VECM). According to the findings of the study, the causal relationship between energy consumption and economic growth in Iran and Nigeria (the growth hypothesis), economic growth, and energy consumption in Bangladesh, Egypt, Malaysia, Pakistan, and Turkey (the conservation hypothesis) was determined in the short term. In Indonesia, no causality (the neutrality hypothesis) was found between the variables. In the long term, as in the short term, findings regarding the growth hypothesis in Nigeria and the conservation hypothesis in Egypt were acquired. On the other hand, it was determined that energy consumption in the long term increases efficiency in all countries except Egypt. The research results determine the evidence of causality in either one or both directions between energy consumption and GDP in all countries in both the long term and the short term, except for Indonesia in the short term.

Masih and Masih (1996), one of the other researchers who examined the relationships between electricity consumption and economic growth and included D8 countries in their models, in particular, studied the data of 6 Asian countries (India, Pakistan, Indonesia, Malaysia, Singapore, and the Philippines) using Granger causality test over the period of 1955 and 1990. Their research concluded that the conservation hypothesis is valid in Indonesia, and the feedback hypothesis is valid in Indonesia. The cointegration correlation between variables was not identified in Malaysia, and therefore no analysis was conducted for the causality relationship. In another study, Murry and Nan (1996) conducted a Granger causality test with the help of 1970-1990 data from 23 OECD countries, including Indonesia, Malaysia, Pakistan, and Turkey. They found evidence for the existence of the conservation hypothesis in Indonesia and the growth hypothesis in Malaysia, Pakistan, and Turkey. Asafu-Adjaye (2000) examined the data of the 1973-1995 period in India, Indonesia, the Philippines, and Thailand, Indonesia, with cointegration and error-correction modelling techniques and observed that the growth hypothesis is valid. Wolde-Rafael (2006) obtained data from 17 African countries, including Egypt and Nigeria, in the period of 1971-2001, and the findings of their study with the Toda-Yamamoto causality method indicated that the feedback hypothesis is valid in Egypt. Yoo (2006) found out that the conservation hypothesis is valid in Indonesia, and the feedback hypothesis is valid in Malaysia in his study using the VAR method with data from the period of 1971-2002 from Indonesia, Malaysia, Singapore, and Thailand. In another study, Chen et al. (2007), using data from the period 1971-2001 of 10 Asian countries, including Indonesia and Malaysia, reached the results of the growth hypothesis in Indonesia and the validity of the conservation hypothesis in Malaysia. Using the data of 1980-2003 of OPEC countries, including Indonesia, Iran, and Nigeria, and performing the ARDL bounds test and Toda-Yamamoto causality methods, Squalli (2007) identified a long-term relationship between economic growth and electricity consumption according to the bounds test results of all three countries. In the Toda-Yamamoto causality test, the growth hypothesis was determined in Indonesia and Nigeria and the feedback hypothesis in Iran. Narayan and Prasad (2008) concluded the validity of the neutrality hypothesis in Turkey by using a causal bootstrapping method with data from 30 OECD countries, including Turkey, in the period of 1960 and 2002. In Asghar's (2008) study, the findings of the Error Correction Model and Toda-Yamamoto causality test for 5 South Asian countries (Pakistan, India, Sri Lanka, Bangladesh,

and Nepal) revealed that the conservation hypothesis is valid in Pakistan and Bangladesh. Öztürk and Acaravcı (2011) investigated the data of 11 Middle East and North Africa (MENA) countries, including Iran and Egypt, with the data of Autoregressive Distributed Lag (ARDL) bounds testing with the data of 1971-2006 period. In the findings of the study, no cointegration relationship between economic growth and electricity consumption in Iran was concluded. In Egypt, findings show the existence of the neutrality hypothesis. Hossain and Saeki (2011), on the other hand, carried out a study in South Asian countries (Bangladesh, India, Iran, Nepal, Pakistan, and Sri-Lanka) using the Granger causality test with the data of 1971-2007 and suggested that there is the conservation hypothesis in Pakistan and the growth hypothesis in Bangladesh. For Iran, the relationships between variables were found to be statistically insignificant. In his study, Abbas and Choudhury (2013), who involved Pakistan and India, which are among the countries with high population density, determined that there is a causality relationship from agricultural growth to agricultural electricity consumption (the conservation hypothesis) in Pakistan based on the monthly data for the period of 2009-2010. Finally, Kar et al. (2019) conducted a study on data from the period of 1970-2014 of 15 developing countries. The findings of the study showed that the growth hypothesis is valid in Indonesia, Pakistan, Malaysia, and Turkey.

There are studies that focus on the relationships between electricity consumption and economic growth in the context of the D8 countries. Studies conducted specific to Bangladesh found out the conservation hypothesis by Mozumder and Marathe (2007) and Amin (2008), and the growth hypothesis by Amin and Murshed (2017). In their study findings, Ahamad and Islam (2011) concluded results for the existence of a short-term growth hypothesis and a long-term feedback hypothesis between variables. Sarker et al. (2019) found that the feedback hypothesis is valid between variables in the long term, while Dey (2019) suggested that the conservation hypothesis is valid in the short term and the feedback hypothesis in the long term.

Sharaf (2017), who conducted a study for Egypt, obtained findings regarding the existence of the neutrality hypothesis in his study. Yoo and Kim (2006) determined that the conservation hypothesis is valid in Indonesia and Zamani (2006) in Iran. In addition, Zamani (2007)

observed the feedback hypothesis between electricity consumption and agricultural sector value-added.

In the findings of the studies conducted for Malaysia, the researchers Chandran et al. (2010) and Thaker et al. (2019) determined the presence of a growth hypothesis, and Shaari et al. (2013) found a conservation hypothesis. Tang (2008) concluded that the feedback hypothesis is valid in Malaysia.

Akinlo (2009), Iyke (2015), Bekun and Agboola (2019), and Ali et al. (2020) determined the growth hypothesis for Nigeria, while Akinwale et al. (2013) observed that the conservation hypothesis is valid. Besides, Ogundipe and Adapa (2013) decided that the feedback hypothesis is valid, and Adenuga and Ochu (2013) obtained results regarding the presence of the neutrality hypothesis in the findings of their studies.

In Pakistan, Jamil and Ahmad (2010) and Shahbaz and Feridun (2011) found the conservation hypothesis in their studies, Aqeel and Butt (2001), Javid et al. (2013) and Ali et al. (2020) suggested that the growth hypothesis is valid. Shahbaz and Lean (2012) obtained findings for feedback hypothesis between variables, whereas Kumar and Begam (2019) reached findings of the neutrality hypothesis.

In studies specific to Turkey, Altınay and Karagöl (2005), Kar and Kınık (2008), Ağır and Kar (2010), Acaravcı (2010), Saatçi and Dumrul (2013), Eren et al. (2016), and Aydın (2018) determined that the growth hypothesis is valid, while Kapusuzoğlu and Karan (2010) and Özata (2010) found that the conservation hypothesis is valid. Yapraklı and Yurttaçıkmaz (2012), Aslan (2014), and Öncel et al. (2017) observed that the feedback hypothesis was valid.

When the studies and findings in the literature review are evaluated in general, it can be argued that different results are acquired in various studies. The most important reasons for this are the differences between country groups, periods, methodologies, countries' levels of development, and energy dependence.

3. Research Data

In line with the objective of the study, the gross domestic product (LGDP) and electricity consumption (LEC) variables of the D8 countries

(Bangladesh, Egypt, Indonesia, Iran, Malaysia, Nigeria, Pakistan, and Turkey) taken from the World Bank Database are used in the research analyses. Since the most extensive time series of variables in the World Bank database is the period of 1971-2014, this period was included in the model. Descriptive statistics of the variables of countries are given in Table 1.

Table 1: Descriptive Statistics

Variables	LGDP_BGD	LGDP_EGY	LGDP_IDN	LGDP_IRN	LGDP_MYS	LGDP_NGA	LGDP_PAK	LGDP_TUR
Mean	24.6414	25.2127	26.5101	26.4251	25.2789	25.8777	25.1217	26.6872
Median	24.5811	25.2629	26.6205	26.3903	25.3510	25.7139	25.2347	26.6932
Max.	25.7136	26.2017	27.5714	26.9377	26.4736	26.8375	26.0506	27.6561
Min.	23.7901	23.9898	25.2756	25.8915	23.8489	25.4041	24.0400	25.7693
Std. Dev.	0.5693	0.6718	0.6545	0.2935	0.7853	0.42272	0.6219	0.53158
Jarque-Bera	2.7665	2.47493	2.3789	1.8613	3.0799	6.92253	2.9906	2.21648
J-B Prob.	0.25076	0.2901	0.3043	0.3942	0.2143	0.0313	0.2241	0.33013
Observ.	44	44	44	44	44	44	44	44
Variables	LEC_BGD	LEC_EGY	LEC_IDN	LEC_IRN	LEC_MYS	LEC_NGA	LEC_PAK	LEC_TUR
Mean	4.1226	6.522	5.0168	6.9655	7.2538	4.4077	5.5334	6.9084
Median	4.1542	6.56	5.315	6.993	7.2966	4.4671	5.8101	6.9839
Max.	5.7689	7.43	6.6993	8.0137	8.445	5.0549	6.1446	7.954
Min.	2.3661	5.285	2.6639	5.6136	5.7466	3.3523	4.5105	5.5065
Std. Dev.	1.0068	0.653	1.2828	0.6692	0.83	0.4243	0.5427	0.7255
Jarque-Bera	2.6039	2.3812	3.883	2.2156	3.4151	3.8763	4.972	2.747
J-B Prob.	0.2719	0.304	0.1434	0.3302	0.1813	0.1439	0.0832	0.2532
Observ.	44	44	44	44	44	44	44	44

According to Table 1, based on an average of 44 years, the highest gross domestic product is in Turkey, while the lowest one is in Bangladesh. Also, electricity consumption is highest in Malaysia, while the lowest consumption is in Bangladesh.

4. Methodology

This study tested the relationships between variables with the help of a panel causality test that was developed by Kónya (2006). The key reason for selecting this test is that the test reveals causality relations for each of the countries one by one; moreover, there is no need to perform a unit root and/or cointegration test first. However, the prior conditions for this test are the presence of cross-sectional dependence in models and the requirement for models to be in a heterogeneous structure. This is because, before the Kónya (2006) bootstrap panel causality test, we first tested the presence of cross-sectional dependence in the models. Secondly, we tested the homogeneity/heterogeneity of the slope coefficient in the models. Information on the related tests can be seen below.

4.1. Cross-Sectional Dependence Tests

We tested the relationships between variables with the help of Models 1 and 2. Before the cross-sectional dependence, first, these two models are estimated by the least-squares method; the presence of a cross-section is tested in the residual terms of $u_{i,t}$ and $e_{i,t}$ belonging to these models.

$$LGDP_{i,t} = \beta_0 + \beta_i LEC_{i,t} + u_{i,t} \quad (1)$$

$$LEC_{i,t} = \alpha_0 + \alpha_i LGDP_{i,t} + e_{i,t} \quad (2)$$

In the models, β_0 and α_0 are constant terms; β_i and α_i are slope coefficients. β_i shows the effect of a 1% change in LEC on LGDP; α_i shows the effect of a 1% change in LGDP on LEC. The i is the country dimension of the models; t is the time dimension of the models. The total number of countries (N) means that the total number of all i in the models are 8 countries; T indicates that the whole-time dimension is 44.

For example, in Model 1, the residual terms ($u_{i,t}$) of the model should be inserted in the model in the case of testing cross-sectional dependence. Afterwards, cross-sectional dependence is tested by producing Model 3.

$$u_{i,t} = \alpha_i + \beta'_i x_{i,t} + \varepsilon_{i,t} \quad (3)$$

$x_{i,t}$ in the model shows independent variables at the $k \times 1$ dimension. There is $x_{i,t} = (u_{i,t-1}, \dots, u_{i,t-p})$ in cross-sectional dependence tests for the model. α_i is the constant term coefficient; β'_i is the slope coefficient. It is assumed that the residual term for each of the countries is $(\varepsilon_{i,t} = \varepsilon_{1,t}, \dots, \varepsilon_{N,t})$ $\varepsilon_{i,t} \sim IID(0, \sigma_{i,\varepsilon}^2)$. Test statistics that are obtained in this way inform us about whether there is a cross-section with the help of the below hypotheses. Again, the below hypotheses are tested using the BPLM test of Breusch and Pagan, (1980); the CD_{LM} test of Pesaran (2004); the LM_{adj} test of Pesaran, Ullah, and Yamagata (2008); and the LM_{BC}^2 of Baltagi, Feng, and Kao (2012);

H_0 : $cov(\varepsilon_{i,t}, \varepsilon_{j,t}) = 0$ or $\sigma_{ij} = 0$ ve $i \neq j$. (There is no cross-sectional dependence in Model 1.)

H_1 $cov(\varepsilon_{i,t}, \varepsilon_{j,t}) \neq 0$ or $\sigma_{ij} \neq 0$ (There is cross-sectional dependence in Model 1.)

The probability values of test statistics can be reviewed when the hypotheses are determined. The H_0 hypothesis is denied if the probability values of the test statistics are lower than statistical significance levels such as 10%, 5%, and 1%. This refers to the presence of cross-sectional dependence in the model. Cross-sectional dependence is tested in Model 2 by making the same things for $e_{i,t}$ that is the residual term of Model 2. Cross-sectional dependence in the models means that a shock in one country will create a shock in other countries.

4.2. Homogeneity Test

The model has a homogeneous structure if the slope coefficients of each of the countries in the panel data are equal to a single slope coefficient. The model has a heterogeneous structure if the coefficients of each of the

² Since all these tests were applied in models, further information related to tests could not be given.

countries are different. Determining this situation is both econometrically and economically significant. First, tests change based on the homogeneity in a model whose importance is econometrically specified. Cointegration and panel causality tests can be used if the model is homogeneous, while second-generation panel cointegration and panel causality tests are used if there is no homogeneity. Regarding economic terms, comprehensive evaluations can be made by observing the similarities and differences of countries in the models if there is heterogeneity. This study used a homogeneity test developed by Pesaran and Yamagata (2008) and based on the random coefficients model. Unlike Swamy's (1970) study, the homogeneity test developed by Pesaran and Yamagata (2008) gives reliable results at larger N and T dimensions. We can say for this study that the T = 19 dimension is a long period in terms of panel data models.

$H_0: \alpha_i = \alpha, i = 1, \dots, N$ for all i . (Model is homogenous.)

$H_1: \alpha_i \neq \alpha_j$, some of $i \neq j$ (The coefficient of at least one country is different. Model is heterogeneous.)

Pesaran and Yamagata (2008) suggest $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ ³ are asymptotically powerful to test these hypotheses. H_0 is denied if the probability values of these test statistics are lower than statistical significance values such as 10%, 5%, and 1%. This means that the slope coefficients of the models vary by country.

4.3. Kónya (2006) Bootstrap Panel Causality Test

The panel causality test developed by Kónya (2006;982) reviews relationships between variables based on the SUR developed by Zellner (1962). In addition, it is emphasized that the SUR estimator of Kónya is more effective than the ordinary least squares (OLS) estimator.

The SUR system that includes *LPGDP* and *LEC* variables whose causality relationships are analyzed is as follows:

³ Study of Pesaran and Yamagata (2008) can be reviewed for further information on test statistics.

$$\left. \begin{aligned} LGDP_{1,t} &= \varphi_{1,1} + \sum_{l=1}^{ml_LGDP_1} \alpha_{1,1,l} LGDP_{1,t-1} + \sum_{l=1}^{ml_LEC_1} \beta_{1,1,l} LEC_{1,t-1} + \xi_{1,1,t} \\ LGDP_{2,t} &= \varphi_{1,2} + \sum_{l=1}^{ml_LGDP_1} \alpha_{1,2,l} LGDP_{2,t-1} + \sum_{l=1}^{ml_LEC_1} \beta_{1,2,l} LEC_{2,t-1} + \xi_{1,2,t} \\ &\vdots \\ LGDP_{N,t} &= \varphi_{1,N} + \sum_{l=1}^{ml_LGDP_1} \alpha_{1,N,l} LGDP_{N,t-1} + \sum_{l=1}^{ml_LEC_1} \beta_{1,N,l} LEC_{N,t-1} + \xi_{1,N,t} \end{aligned} \right\} (4)$$

and

$$\left. \begin{aligned} LEC_{1,t} &= \varphi_{2,1} + \sum_{l=1}^{ml_LEC_2} \beta_{2,1,l} LEC_{1,t-1} + \sum_{l=1}^{ml_LGDP_2} \alpha_{2,1,l} LGDP_{1,t-1} + \xi_{2,1,t} \\ LEC_{2,t} &= \varphi_{2,2} + \sum_{l=1}^{ml_LEC_2} \beta_{2,2,l} LEC_{2,t-1} + \sum_{l=1}^{ml_LGDP_2} \alpha_{2,2,l} LGDP_{2,t-1} + \xi_{2,2,t} \\ &\vdots \\ LEC_{N,t} &= \varphi_{2,N} + \sum_{l=1}^{ml_LEC_2} \beta_{2,N,l} LEC_{N,t-1} + \sum_{l=1}^{ml_LGDP_2} \alpha_{2,N,l} LGDP_{N,t-1} + \xi_{2,N,t} \end{aligned} \right\} (5)$$

l lag length represents the lag lengths belonging to ml_LPGDP and ml_LEC in the models. Equations 1–4 are used to test the causality relation from LEC to $LPGDP$; equation 5 tests the causality relation from $LPGDP$ to LEC . These lag lengths are specified by a combination that minimizes the Akaike Information Criterion (AIC) and the Schwartz Information Criterion (SC). As Kónya (2006, p.980) mentioned, every equation system has a vector autoregressive (VAR) (by Sims [1980]) equation based on the number of countries (N). Just as being in VAR equalities, the SUR system has an obligation for variables to be steady or

cointegrated. The reason for this is the simultaneous correlation between the countries' VAR models.

Wald test statistics are computed for each country's VAR equalities in a causality test. Just as in Kónya (2006), these test statistics are compared using critical bootstrap values. In short, the hypotheses can be summarized for each of the countries as follows:

H_0 : *LEC* is not the Granger causality for *LPGDP* for any i country (Model 1); or, *LPGDP* is not the Granger causality for *LEC* (Model 2).

H_1 : *LEC* is the Granger causality of *LPGDP* for any i country (Model 1); or, *LPGDP* is the Granger causality for *LEC* (Model 2).

5. Empirical Results

This part of the study shows the findings that were obtained using the methods above. The test results for cross-sectional dependence can be seen in Table 2.

Table 2: Cross-Section Dependence Test Results

Models	Model 1		Model 2	
Test	Test Statistics	P-value	Test Statistics	P-value
BP_{LM}	775.4206*	0.0001	686.7569*	0.0001
CD_{LM}	98.8092*	0.0001	86.9610*	0.0001
LM_{BC}	98.7162*	0.0001	86.8680*	0.0001
LM_{adj}	24.0536*	0.0001	24.3551*	0.0001
* indicates the rejection of the null hypothesis at the 1% significance level.				

There is cross-sectional dependence in both Model 1 and Model 2. It is inevitable for a shock that occurs in one country in the world to affect other countries. This finding is not surprising. Moreover, this result proves the first condition required for the Kónya (2006) bootstrap panel causality test.

Table 3: Slope Homogeneity Tests Results

Models	Model 1		Model 2	
Test	Test Statistics	P-value	Test Statistics	P-value
$\tilde{\Delta}$	52.995*	0.0001	48.442	0.0001
$\tilde{\Delta}_{adj}$	54.855*	0.0001	50.142	0.0001
* indicates the rejection of the null hypothesis at the 1% significance level.				

Table 3 shows the homogeneity test results. The coefficients for both models vary from country to country; that is, they are heterogeneous in structure. This result provides the second condition required for the Kónya (2006) bootstrap panel causality test.

Table 4: Kónya (2006) Bootstrap Panel Causality Test Results

<i>H₀: LEC is not the Granger causality for LGDP (Model 1)</i>					
Countries	Coefficients	Test Statistics	Critical Values****		
	<i>LEC</i>	Wald	10%	5%	1%
Bangladesh	0.027	2.102	4.410	6.299	11.172
Egypt	0.164	4.579***	4.342	6.214	11.089
Indonesia	-0.022	1.045	4.537	6.818	15.945
Iran	0.230	31.818*	9.035	11.960	21.158
Malaysia	0.128	5.349***	4.417	6.352	11.501
Nigeria	0.041	0.739	4.289	6.095	10.921
Pakistan	-0.020	0.595	4.125	6.098	10.703
Turkey	0.111	1.352	8.560	11.667	18.691

<i>H₀: LGDP is not the Granger causality for LEC (Model 2)</i>					
Countries	Coefficients	Test Statistics	Critical Values****		
	<i>LGDP</i>	Wald	10%	5%	1%
Bangladesh	0.491	7.650	11.847	15.367	23.703
Egypt	0.395	8.461***	7.440	10.474	17.591
Indonesia	0.229	10.331**	5.743	8.051	14.519
Iran	-0.047	2.505	4.872	6.978	12.543
Malaysia	0.295	9.316***	8.017	11.120	18.727
Nigeria	0.242	7.610***	6.340	8.970	14.997
Pakistan	0.066	1.624	6.445	9.079	15.139
Turkey	-0.044	0.210	6.009	8.369	14.816
*, **, *** *, **, and *** indicate rejection of the null hypothesis at the 1, 5, and 10 percent levels of significance, respectively. **** The bootstrap is based on 1000 replications.					

According to the results of the Kónya (2006) bootstrap panel causality test in Table 4, there is a positive and unidirectional causality relationship from *LEC* to *LGDP* in Iran and from *LGDP* to *LEC* in Indonesia and Nigeria. For Egypt and Malaysia, a positive and bidirectional causality relationship was determined between the variables, and no causality relationship was found statistically between the variables in Bangladesh, Pakistan, and Turkey. As the study results clearly indicate, both the existence of causality relationships and the coefficients of the relations vary in different countries.

According to Kónya (2006) bootstrap panel causality test results, it is found out that there is a positive and unidirectional causality relationship from electricity consumption to economic growth (the growth hypothesis) in Iran and from economic growth to electricity consumption (the conservation hypothesis) in Indonesia and Nigeria. For Egypt and

Malaysia, a positive and bidirectional causality relationship (the feedback hypothesis) was determined between the variables, while no causality (the neutrality hypothesis) relationship was found statistically between the variables in Bangladesh, Pakistan, and Turkey.

The findings of this study are in coincidence for Iran with Razzaqi (2011), for Indonesia with Masih and Masih (1996), Murry and Nan (1996), Yoo (2006), and Yoo and Kim (2006), for Nigeria with Akinwale et al. (2013), for Egypt with Wolde-Rafael (2006), for Malaysia with Yoo (2006) and Tang (2008), for Pakistan with Kumar and Begam (2019), and for Turkey with Narayan and Prasad (2008). There are no studies in the literature similar to the findings for Bangladesh alone.

6. Conclusion

In this study, the relationships between the D8 countries' gross domestic product and electricity consumption were investigated by using Kónya (2006) bootstrap panel causality test using data from the period of 1971-2014. According to the test results in the analysis chapter of the study, it was found that there is a positive and unidirectional causality relationship between electricity consumption in Iran and economic growth in Indonesia and Nigeria. Therefore, as a result of the findings, it is understood that while the growth hypothesis is valid in Iran, the conservation hypothesis is valid in Indonesia and Nigeria. In the results of the analysis, it was estimated that there was positive and bidirectional causality between both variables in Egypt and Malaysia. This finding indicates that the feedback hypothesis is valid

in Egypt and Malaysia. In Bangladesh, Pakistan and Turkey, it can be suggested that the neutrality hypothesis is valid in these three countries according to the test results, which statistically do not show any causality relationship between the variables.

The fact that the growth hypothesis is valid in Iran means that any shock in electricity consumption can significantly affect growth. As seen in Table 1, Iran has the second most electricity consumption among the D8 countries after Malaysia. From this point of view, reductions in electricity consumption and conservation policies in Iran may have a negative impact on economic growth. In Iran, which is the third-largest state with the largest oil resources in the world and the second-largest state with

natural gas resources, newer and larger resources are still being discovered. Among OPEC, which is active in determining world oil supplies and therefore prices, Iran is the second-largest producer of oil and gas. In this context, it can be argued that Iran has the potential to increase its national interests and position in the power hierarchy by influencing the accumulation of international capital (Hürsoy and Orhon, 2012: 71). For Iran, which is not energy-dependent and has abundant energy resources, these results are remarkable. Iran has economic and political problems with many countries, especially the United States, due to both regional developments and its nuclear program. As a result of these results obtained from the analysis, it is estimated that this may have occurred because the United States has an isolated economy in the region due to international economic sanctions imposed against Iran. For Iran, whose economy is growing relatively while its energy resources and potential are growing, lifting international economic sanctions could become a great opportunity for Iran, which currently has to cope with economic contraction. Countries and oil companies that want to access to Iran's oil resources are also aware of this situation and are engaged in intense competition and cooperation among themselves (Host, 2017:2). As can be deduced from international economic sanctions, Iran's current energy use is mainly aimed at meeting domestic demand. The relative growth observed in its economy is again due to this domestic demand. At this point, Iran should first go on the path of resolving its existing problems with neighbouring countries by demonstrating a more conciliatory attitude. After that, it should seek ways to present its arguments to the world public opinion on the unfairness of international economic sanctions. In the event that international economic sanctions are lifted, thanks to Iran's existing energy wealth and economic capacity, it will open up new trade and energy routes for Iran, then the Middle East and Europe.

For Indonesia, the findings support the conservation hypothesis, which means growth increases electricity consumption. According to the World Bank data, for a developing country with approximately 5% growth, 4.5% unemployment, and 2.7% inflation rate in 2019, these data of Indonesia are also a sign that things are on the right track. Nevertheless, Indonesia is one of the fastest-growing economies in Asia and concentrated on producing high-tech products; therefore, it has the most basic need for energy. Energy dependency is one of the biggest problems for the Indonesian economy. This result is far from sustainable for the oil

importer Indonesia, which has oil and gas reserves but does not have sufficient energy resources. The Indonesian government has acknowledged the importance of energy access, as contained in Indonesia's Energy Law No 30/2007 (Sambodo and Novandra, 2019:113). The Indonesian government has adopted policies aimed at improving energy access by establishing energy security through its medium-term development plan for the period 2014 and 2019. In addition, the government implements incentive policies for the use of renewable energy based on local resources (Sambodo and Novandra, 2019). In this respect, it is beneficial for Indonesia to concentrate on alternative energy sources to disburden its energy dependence and increase its electricity consumption. The fact that this problem has been identified by the Indonesian government and implemented long-and medium-term development plans on this issue is a good sign for the future of the Indonesian economy. Besides, the World Bank (2019) approved a substantial loan to enable Indonesia to have geothermal resources, one of the wealthiest renewable energy sources in the world.

In Nigeria, results have been collected for the validity of the conservation hypothesis. This hypothesis applies to countries with low energy dependence. Nigeria's economy appears to be predominantly dependent on oil revenues. Apart from oil, agriculture and trade by traditional methods also have an important place in the country's economy (Bıçakçı, 2019:7). The workforce employed in Nigeria's industrial sector is 12%, according to the World Bank database. The share of the industrial sector in domestic income is 27.4%. With a population of over 200 million, the agricultural sector, which employs 35% of Nigeria's labour force, has a share of domestic income of 21.9% in 2019. The agricultural sector has a significant employment share in the country. Nigeria's agricultural sector appears to have significant employment. On the other hand, security problems in Nigeria also negatively impact the economy. The Boko Haram rebellion, kidnappings, and the Niger Delta problem, where oil pipelines are often targeted, are among Nigeria's most important security problems. Additionally, Nigeria, one of the world's largest oil producers and one of Africa's largest economies, has been identified as the country where the largest number of people live in extreme poverty. The Nigerian economy, whose oil revenues account for about 75% of the federal budget, entered a recession in September 2017 for the first time in more than 20 years and has shown only modest signs of growth since then. While the administration's efforts to diversify the country's economic

activities continue, there has been no improvement in unemployment and poverty. Unemployment is the biggest problem in Nigeria. About a quarter of the population is unemployed, and two-thirds of the population live below the poverty line (INSAMER, 2020). All these data indicate that Nigeria's social and economic problems cannot be solved with oil and gas revenues. First of all, it is necessary for the country to find a solution to the problem of unemployment. For this purpose, priority must be given to real sectors such as agriculture to realize diversified, inclusive, and sustainable development. In contrast to the oil and gas sector, increasing investment in Nigeria's agricultural sector, which provides the most jobs, could contribute to reducing poverty and inequality.

There are findings that the feedback hypothesis is valid in Egypt. It can be inferred from this case that Egypt, which has sufficient energy resources, has sufficient resources for its current economic activity capacity. However, considering Egypt's current economic capacity, two basic energy resources of oil and natural gas, young and mostly well-trained manpower and tourism opportunities, it cannot be suggested that macroeconomic indicators are very good (Ansarian, 2020: 45). On the other hand, in Egypt, whose real GDP grew by 5.6% in 2019, natural gas, tourism and construction sectors have been the main drivers of growth from a sectoral point of view. Egypt's unemployment rate is around 7.5%, and its non-oil exports are also slow (The World Bank, 2020). Besides, Egypt's increasing the capacity of the active sectors in the country's economy and the productivity of the idle sectors may have a jump-off effect on their economy, which is a significant threshold. The most basic requirement of Egypt, which is part of the developing country group, is the lack of existing capital accumulation. At this point, most foreign capital investments are of serious importance. One of the most important conditions for attracting foreign investors to domestic markets is the formation of stable political ground. The presence of coups in Egypt's historical past is likely to cause foreign investors to invest more cautiously in Egypt. Based on the World Bank data, especially since 2011, there has been a remarkable increase in foreign capital investment in Egypt. On the other hand, Egypt should also support its energy sources with other renewable energy sources. Although these existing energy sources seem to support the current economy, in the long run, this situation is far from sustainable.

The study's findings also revealed that the feedback hypothesis is valid in Malaysia. Based on the data in Table 1, Malaysia has the highest electricity consumption among the D8 countries during the period covered. Like Indonesia, Malaysia is among Southeast Asia's fastest-growing and leading countries in high-tech product exports. It is likely that such an economy has high electricity consumption. In terms of economy, Malaysia has achieved stability in its region and is a very good country with a level of prosperity. In a country with a global economic structure, the service sector, industry, agriculture, mining, and energy resources are important elements of the economy (Bulut, 2019:44). 23% of Malaysia's industrial output comes from the mining sector, which is mostly oil and natural gas production. Although Malaysia is a small-scale oil exporter, it is a major natural gas exporter. The country can meet more than 80% of its oil needs. Because the oil produced in the country is of high quality, exports are made, and domestic needs are met by imports (Koç, 2014:7). In addition to the existence of all this energy wealth, Malaysian governments have consistently given significant support to the energy sector in history (Razzaqi, 2011:455). It can be thought that the positive progress of macroeconomic performances of Malaysia, which has a stable economic and political structure and adopts the export-oriented industrialization policy, can be thought to contribute to the positive and stable policies in energy policies.

In Bangladesh, Pakistan, and Turkey, the neutrality hypothesis was found to be valid. In other words, there is no interaction between electricity consumption and economic growth. This result reflects that these three countries primarily have fundamental problems to increase their energy needs as well as their production capacity. Bangladesh is the country with the lowest income and lowest electricity consumption in this group of countries, as shown in Table 1. Bangladesh does not have enough energy resources nor adequate economic infrastructure in terms of production. Turkey and Pakistan also do not have energy resources, and they are among the energy importing countries. Although Turkey appears to be the country with the highest income according to Table 1 and the highest electricity consumption after Malaysia and Iran, this table shows the existence of significant economic infrastructure deficiencies in Turkey. A similar problem applies to Pakistan. Especially in Bangladesh, Pakistan, and Turkey, important structural reforms for both the industrial sector and the energy sector must be carried out urgently. Policies to reduce energy

imports, which have the most negative effects on the balance of payments, should be implemented in these developing countries.

In a general assessment, D8 countries must first use their resources in the most efficient way, make savings, and produce goods and services that can be the subject of high value-added exports to complete their industrialization processes and become a part of the developed countries. In terms of energy demand, the governments of D8 countries should subsidize the companies in the energy sector, and the necessary steps should be taken by identifying deficiencies within the framework of cooperation between the public, private sector, and universities. Specifically, the geography and climate of this group of countries are well suited for renewable energy production. They can only ease energy imports, one of the most significant burdens on the nation's economies, through access to renewable energy sources. Countries with energy resources, on the other hand, should use these resources in the most efficient way and for the production of products with higher added value. In addition, energy supply countries should concentrate on sectors that will diversify their revenue items as well as energy revenues. It can be useful for the D8 countries to pursue a common policy that will benefit from each other's experience for economic growth and energy demand.

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Effect of Liquidity and Credit Risk on Banking Performance: Evidence from Sub Saharan Africa

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ABSTRACT

Risk is a great impediment confronting the performance of banks in Sub Saharan Africa. Liquidity and credit risk are the dominant form of risk affecting banking performance. This study seeks to examine the effect of liquidity risk and credit risk on the performance of banks in Sub Saharan Africa. The study used a sample of fifty (50) banks drawn across six Sub Saharan African countries that include Nigeria, Ghana, South Africa, Zambia, Kenya, and Tanzania. The two-step system generalized method of moment is the analysis tool used in the study. The findings from the study revealed that liquidity risk and credit risk are separately and jointly significant and negatively contribute to the performance of banks in Sub Saharan Africa. Banks management and practitioners are therefore encouraged to employ all the necessary measures to manage these risks under a single control as proposed in the Basel III regulatory provisions.

ملخص

تشكل المخاطر عائقا كبيرا يعترض أداء المصارف في أفريقيا جنوب الصحراء الكبرى. وتعتبر مخاطر السيولة والائتمان الشكل السائد للمخاطر التي تؤثر على الأداء المصرفي. وتسعى هذه الورقة إلى دراسة أثر مخاطر السيولة والائتمان على أداء المصارف في أفريقيا جنوب الصحراء الكبرى. وقد استخدمت الدراسة عينة تتكون من خمسين بنكا تم اختبارها من ست دول أفريقية تقع في جنوب الصحراء الكبرى تشمل كل من نيجيريا وغانا وجنوب أفريقيا وزامبيا وكينيا وتانزانيا. ويعتبر أسلوب اللحظات المعمم (GMM) على خطوتين أداة التحليل المستخدمة في الدراسة. وقد كشفت النتائج التي خلصت إليها الدراسة أن مخاطر السيولة والائتمان تتسم بأهمية منفصلة ومشتركة وتساهم سلبا في أداء

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المصارف في أفريقيا جنوب الصحراء الكبرى. ولذلك تشجع إدارة المصارف والممارسين على استخدام جميع التدابير اللازمة لإدارة هذه المخاطر تحت رقابة واحدة على النحو المقترح في الأحكام التنظيمية لاتفاقية بازل الثالثة. الكلمات الرئيسية: مخاطر السيولة، ومخاطر الائتمان، ونظام أسلوب اللحظات المعمم (GMM)، هامش صافي الفائدة (NIM)، والعائد على الأصول (ROA)، أفريقيا جنوب الصحراء الكبرى (SSA).

ABSTRAITE

Le risque est un obstacle majeur à la performance des banques en Afrique subsaharienne. Le risque de liquidité et le risque de crédit sont les formes dominantes de risque qui affectent la performance des banques. Cette étude vise à examiner l'effet du risque de liquidité et du risque de crédit sur la performance des banques en Afrique subsaharienne. L'étude a utilisé un échantillon de cinquante (50) banques réparties dans six pays d'Afrique subsaharienne, à savoir le Nigeria, le Ghana, l'Afrique du Sud, la Zambie, le Kenya et la Tanzanie. La méthode des moments généralisés du système à deux étapes est l'outil d'analyse utilisé dans l'étude. Les résultats de l'étude ont révélé que le risque de liquidité et le risque de crédit sont séparément et conjointement significatifs et contribuent négativement à la performance des banques en Afrique subsaharienne. La direction des banques et les praticiens sont donc encouragés à employer toutes les mesures nécessaires pour gérer ces risques sous un contrôle unique comme le proposent les dispositions réglementaires de Bâle III.

Keywords: Liquidity risk, Credit risk, system GMM, ROA, NIM, SSA

JEL Classification: F3, G21. 016, 053

1. Introduction

The global financial crisis of 2007-2009 had exposed banking performance to different forms of risks. The banking sector is among the most important industry in the economy and it is a known fact that banks have many peculiarities compared to industrial firms. Banks ensure mobilisation and efficient allocation of funds from surplus to deficit units Fama, (1980). According to Cecchetti and Schoenholtz, (2011), banks are faced with several financial risks comprise of the probability that deposits will suddenly be withdrawn by depositors (liquidity risk), non-repayment of loans on time by borrowers (credit risk), change in interest rates (interest-rate risk), the collapse of banking structures or failures of their computer system (operational risk). The activities of banks are usually

affected by the two most important in the sector that includes liquidity and credit risk (Ghenimi, Chaibi, & Omri, 2017).

In an attempt to identify the functions of banks, Richard, (2016), traces three banking theories. The first theory of banking according to him sees a bank as an institution that receives from savers and gives it to investors. The reserve theory of banking is the second; it believes that money in banks is created through multiple deposit expansion as a collective banking system. It sees the bank as a financial intermediary. The argument for the third banking theory believes that bank has the authority for money creation and credit through new loan extension, it rejects the financial intermediary role of banks. All the theories, particularly, the financial intermediation theory, impliedly proved that there is some association between credit risk and liquidity risk.

Empirical and theoretical results are supported during the global financial crisis by anecdotal evidence from bank failures. Office of the Comptroller of the Currency (OCC) and Federal Deposit Insurance Corporation (FDIC) reports that credit and liquidity risk contributed to a large number of failures among commercial banks during the global financial crisis. Liquidity risk is attributed to profit-lowering cost, a default in loan raises liquidity due to depreciation it caused and lowered cash inflow (Dermine, 1986). Therefore, based on the literature, the relationship between credit and liquidity risk is positive. Meanwhile, at the time of the crisis, there is a movement of risk among banks, from bank runs or deposit withdrawal risk to a risk of other funding sources dry up, particularly, interbank market (Borio, 2010; Huang & Ratnovski, 2011). As a result of asymmetries information in the loan market, on the other hand, credit risk affects a large number of banks (Heider, Hoerova, & Holthausen, 2009). Hence, bank failures are experienced following a mutual reinforcement between liquidity and credit risk.

Moreover, Following, the global financial crisis, large number of literature make on the positive association between liquidity and credit (Allen, and, Carletti, 2008; Cornett, McNutt, Strahan, & Tehranian, 2011; Gefang, Koop, & Potter, 2011; Imbierowicz & Rauch, 2014). The association between credit risk and liquidity risk among US banks is examined between 1998 and 2010 (Imbierowicz & Rauch, 2014). Their findings revealed a weak positive interrelationship of credit and liquidity

risk using bank-specific attributes, but they indicate a positive and robust association with bank external credit risk and internal liquidity.

Equity capital and deposits constitute the main sources of banks' funding and must meet the standard of capital adequacy ratio for the banks to be safe (Broll, Welzel, & Wong, 2018). Moreover, Cornett, et al., (2011), posits that liquidity from the market is affected by the financial crisis. They classified banks into two classes; i.) banks with equity capital finance and deposits as the main funding source, continue lending more with other banks, and ii.) banks, with increase illiquid assets, minimize their lending to contribute to their liquidity. Finally, in monitoring their liquidity, banks compelled them to minimize the supply of credit, which lead to minimizing the credit risk. This as well exhibits copositive movement.

Acharya, Shin, and Yorulmazer,(2011); Tirole, (2011), clearly proposed regulations of liquidity. Although, depending heavenly on the interbank market by banks, a rise in the requirements of capital can be explained as a suitable measure of both liquidity risk and insolvency. Despite that Acharya and Viswanathan, (2011) and Heider et al., (2009), have already revealed that liquidity and credit risks collectively influence and interact with the performance of banks. Part of the contribution of the work of Imbierowicz and Rauch, (2014), among commercial banks in the US, revealed that liquidity and credit risk collectively influence the performance of the bank. Moreover, Vazquez and Federico, (2012), in their study among American and European banks conclude that a joint exposure to liquidity and credit risk increases the challenges of the banks. The focus of our paper is on the post-global crisis effect of liquidity and credit risk on the performance of Sub Saharan African region.

Our study analyzes the effect of liquidity and credit risks on banking performance in a post-financial crisis. Previous studies largely focus on the effect of both liquidity and credit risk during a financial crisis. As a first step, the study would look at the separate impact of liquidity and credit risk on bank performance. In the second aspect, the study will also analyze the joint effect of liquidity and credit risk on bank performance.

The limited researches from Sub Saharan Africa on the effect of liquidity and credit risk on banking performance motivated this study. Most of the attention of global scholars is focused on developed countries, Asia and

MENA region, with limited attention given to Sub Saharan African region, despite the continued problems and threat posed by these risks on the banking sector and the economy of the region at large. Moreover, the region is seen to have vast investment opportunities and the prospect of their banking sector is likely to attract investors and bankers worldwide. With the scarcity of studies in this area, our focus will be on the examination of the effect of liquidity and credit risk on banking performance in the context of Sub Saharan Africa.

The study is expected to make the following contributions. The study found that each liquidity risk and credit risk is significant and negatively affects the performance of banks in Sub Saharan Africa. Their interaction effect is also significant and negatively affects the performance of banks in the region.

The remainder of the paper is organized as follows. Section 2 presents the review of related literature. Section 3 discusses the data and methodology used. Section 4 reports results and discussions. Section 5 explains the conclusion and policy implication.

2. Literature Review

2.1 Concept of Liquidity risk

Liquidity risk is the future loss affecting an established institution emanating from either increase funding in an asset as they become due without incurring unacceptable losses or cost, or its inability to meet its obligation (Arif & Anees, 2012). According to the Comptroller of the Currency, (2001), liquidity risk is a risk emanating from a bank's inability to satisfy its obligations as they become due without incurring unacceptable losses. This risk can wreak havoc on both the capital and bank's earnings. This therefore must be treated with urgency by bank management to make funds available to satisfy potential requests of borrowers and providers at affordable cost. Liquidity is simply defined according to Muranaga and Ohsawa, (2002), as a risk of being unable to liquidate a position timely at a reasonable price. Two components of liquidity risk are emphasized here. Liquidating an asset when required and at a fair market value.

Based on the opinion of Goodhart, (2008), liquidity risk consists of two basic components: the inherent liquidity of a bank's asset (the degree to which asset can be deposited without incurring an important value loss under any market condition) and maturity transformation (the maturity of a bank's asset and liabilities). In reality, these two components of a bank's liquidity are interlinked. Banks need not panic about the maturity transformation if they own an asset that can be sold without incurring any loss. Whereas, banks may have less need to maintain the liquid assets if they hold assets that are maturing in a shorter period. Aside from the issue of maturity mismatch, liquidity risk may be caused by recessionary economic conditions, which affect resource generation. This raises depositors to demand leading to liquidity risk. A particular bank or even the entire banking system may fail due to this, as a result of the contagion effect (Diamond & Rajan, 2005).

2.2 Concept of Credit Risk

Credit risk may be seen as the uncertainty related to future loss of a value on a fixed income either interest or principal in the event of default, widening, or downgrade of credit spreads (Jacobs Jr, Karagozoglu, & Layish, 2016). BCBS, (2001), posits that credit risk is the dominant risk in the banking sector. According to Jorion, (2009), credit risk is the economic loss from the failure of the counterparty to meet its contractual obligations. Credit risk is mainly caused by non-compliance of debtors with their commitments scheduled, which exist in their contractual terms (Ferhi, 2018). Credit is often seen as the process of lending and borrowing money. Simply put, it refers to a financial instrument that involves predetermined fixed payment, which is effected over a certain period or a loan given to a borrower.

On the other hand, Anita, (2008), defined credit risk as the future loss of valuable assets caused by likely deterioration in the creditworthiness of the counterparty or its inability to meet contractual obligations. Moreover, firms involved in a securities transaction may be confronted with credit risk as well due to their commitment to the derivatives market, lending or borrowing securities, and marking margin loans to customers. Credit risk depends on the ability of borrowers to generate sufficient cash flow earnings, operations, and sales of assets to meet their future principal and interest payment of the outstanding debt (Manab, Theng, & Md-Rus, 2015).

2.3 Determinant of Liquidity and Credit Risk

2.3.1 Micro Determinants

Determinants of liquidity and credit can be seen from the perspective of bank-specific factors as well as from macroeconomic factors. With regards to bank-specific factors of credit risk, the literature revealed many determinants that include a low level of capital, low efficiency, poor management, and surplus lending undertaken by high-risk banks. In particular, low-cost efficiency banks are mishandled with weak loan underwriting, poor control, and monitoring which leads to the rising level of credit risk (Berger & Humphrey, 1997; Podpiera & Weill, 2008). In contrast, high cost could mean that banks fail in distributing sufficient resources to manage risks and due to that, credit risk increases whereas certain performance ratios are indirectly related to credit risk. Moral hazard hypothesis posits that high-risk banks are usually associated with low capital and higher credit risk chance (Keeton & Morris, 1987). However, low liquidity banks, measured by loan to their asset ratio or deposit ratio are more exposed to a high level of credit risk due to their inability to contain funding gaps. The surge in the presence of Islamic bank in the Malaysian banking sector, minimize the risk within it, hence raising the efficiency-risk tradeoff (Ibrahim, 2020).

On the other hand, a bank's deposit loan loss provision is also an important determinant of the liquidity risk of banks. Kwal, Lee, and Eldridge, (2009), reveal that DLLP is associated positively with the securities gain realized, external financing demand, and prior year taxes. The dominance of withdrawal and high liquidity risks in banking motivates a rise in scrutiny over banks' loan provision decisions, (Hasan & Dridi, 2011; Olson & Zoubi, 2008). Liquidity risk is significantly affected by the capital adequacy of banks. Acharya et al., (2011), show that banks may take more risk due to their capital position and create liquidity by giving out more loans. Distinguin, Roulet, and Tarazi, (2013), evaluate the association between bank liquidity and regulatory bank capital, findings indicate that the regulatory capital of banks is minimized when they are largely involved in the creation of liquidity and confront with a less net stable funding ratio.

Liquidity risk is also affected by bank size. A study on Saudi and Jordan banks' liquidity risk between 2007 to 2011, by Abdel Karim, (2013),

reveals that Saudi bank size is negatively associated with liquidity risk. Choon et al., (2013), indicate a significant association between liquidity risk and bank size. Some studies explore the relationship between bank liquidity and profitability ratios (Choon et al., 2013; Lartey, Antwi, & Boadi, 2013). The association of liquidity risk and performance at the time of the global financial crisis had been examined, and findings indicate that performance and liquidity risk are negatively associated (Ariffin, 2012). Abdel Karim, (2013), shows that return on equity and liquidity risk are negatively associated, while return on asset is associated positively with liquidity risk. Delechat, Henao Arbelaez, Muthooru, and Vtyurina, (2012), find that profitability affects bank liquidity negatively.

2.3.2 Macro Determinants

At a macro level, both credit risk and liquidity risk are affected by macro-economic factors, comprising mainly of gross domestic product and inflation. A stable macroeconomic atmosphere offers chances for hedging risks and provides varieties of choice of monetary, fiscal, and exchange rate policies (Ehigiamusoe & Lean, 2017). A study by Sulaiman, Mohamad, and Samsudin, (2013), revealed that GDP and liquidity risk are inversely related. Choon et al., (2013), in their study, reveal a positive effect of GDP on bank liquidity while Aspachs, Nier, and Tieset, (2005), show that UK banks seem to maintain a smaller amount of liquidity when there is a decrease in GDP. On the other hand, Lassoued, (2017), reports that GDP has a significant negative association with credit risk. This implies that in a period of economic growth credit risk decreases. Ahlin, Lin, and Maio, (2011), show that economic growth boosts financial sustainability by reducing defaults. In contrast, Fonseca and Gonzalez, (2008), indicate that growth and portfolio risk have a positive relationship.

Inflation is another macroeconomic factor that affects both liquidity and credit risk. According to Ashraf, Rahman, Rahman, and Zheng, (2018), showed a positive impact of inflation on liquidity risk. This is in line with the results of Sulaiman et al., (2013). In contrast, Yacoob, Abdul Rahman, and Abdul Karim, (2016), revealed that liquidity positions of banks are increase in an inflationary environment to safeguard depositors, and necessary precautions are taken against a bank run risk. On the other hand, Lassoued, (2017), maintains that an increase in inflation rates affects borrowers' solvency because an increase in price leads to a

decrease in the real income of households. His findings reveal that inflation has a positive relationship with credit risk.

2.4 Relationship between Liquidity and Credit Risk on Banks Performance

Some empirical studies are conducted either on liquidity risk, credit risk, or a study with the interaction of liquidity and credit risk. Each of the studies affects banking performance in one way or the other. A few studies are reported below; Arif and Anees, (2012), in their study, examine liquidity risk in Pakistan banks and analyze its effects on bank's profitability. The study employed 22 banks between 2004 to 2009, using multiple regression techniques. The findings indicate that profitability is significantly affected by liquidity risk, with the non-performing loan and liquidity gap as the two factors exacerbating the liquidity risk. They have a negative association with bank performance. They have a negative association with bank performance.

Elbadry, (2018) in his study, investigate the effect of Saudi bank's financial stability on risk management. The results of the study revealed a significant and negative impact of capital adequacy ratio on credit risk. Moreover, the leverage ratio has a significant positive effect on credit risk. Furthermore, the findings show a significant negative impact of leverage, provisions, bank size, the ratio of loan to deposit on liquidity risk. Varotto, (2011), the study evaluated the association between credit risk and liquidity risk, and the result is used to find the incremental risk charge (IRC), the recent credit risk capital, the latest credit capital add-on for banks trading books introduced by the Basel Committee. The result revealed that despite the (incremental) credit risk may be seen as an option in the trading book, the capital requirements to sustain associated losses of market risk in a highly volatile condition can be more than ten times.

Fatemi and Fooladi, (2006), investigate credit risk management contemporary practice by the U.S based largest financial institutions. Findings revealed tracing counterparty default is one of the most crucial aims served by the models of the credit risk utilized. Apanga, Appiah, and Arthur, (2015), the study evaluates practices of credit risk management within Ghana financial institutions. The research makes a comparison on practices of credit risk management of listed Ghana banks with Basel II

(1999). The result of the study shows that credit risk management practices within listed banks in Ghana are in line with sound practice.

Ko, Lee, and Anandarajan, (2019), the paper analyses the relationship between credit risk, operational risk, corporate governance, and performance of the firm. Results from the study show that a higher probability of credit default is linked to a higher level of operational risks incident and to poor performance. The study revealed, more importantly, that higher-quality corporate governance is related to low-level operational risk incidents, improved performance, and less probability of credit fault.

Other empirical literature focuses on looking at the joint effect of liquidity and credit risk on banks. A study by Imbierowicz and Rauch, (2014), examines the association between credit risk and liquidity risk. The study used all the sample U.S commercial banks from 1998 to 2010. Results of the study reveal both risks separately increase the probability of default, and the effect of their interaction depends on the overall level of bank risk and can either increase or minimize default risk. In the study, Hassan, Khan, and Paltrinieri, (2018), the study evaluated the association between liquidity and credit risk through an assessment of Islamic banks and conventional banks from the selected organization of Islamic cooperation countries for the period of 2007-2015. The findings indicate that liquidity and credit risk has a negative relationship. The results finally confirmed Islamic banks to be better in terms of risk management than conventional banks.

Ghenimi et al., (2017), in their study that assesses the effect of liquidity risk and credit risk on banking stability. The study used a sample of 49 banks operating in the MENA region throughout 2006-2013. Results from the study show that credit risk and liquidity risk do not have time-lagged or any economically reasonable association. Although, the risk individually influence the stability of bank and bank instability is enhanced with their interaction. Based on the above empirical evidence, the following hypothesis are developed.

H₀₁: There is a significant negative relationship between liquidity risk and bank performance in SSA

H₀₂: There is a significant negative relationship between credit risk and bank performance in SSA

H₀₃: There is a significant positive relationship between the interaction of liquidity risk and credit i.e they jointly increase or decrease.

3. Data and Methodology

3.1 Data

The study employed panel data with 450-year observation. Fifty banks are drawn from six Sub Saharan African countries that include Nigeria, Ghana, South Africa, Zambia, Kenya, and Tanzania, over 9 years starting from 2010 to 2018. The selection of the countries was based on the report by the international institute of finance in 2016 that classified those countries as the largest financial market in the Sub Saharan African region. The data are sourced from the Thomson and Reuters data stream and annual financial reports of the individual banks, while the World bank open data source supplements, the data for the macroeconomic level data. The paper aim at examining the effect of liquidity and credit risk on the performance of banks in the Sub Saharan region. The study model is given below and developed based on the study of (Ghenimi et al., 2017).

$$\begin{aligned} \textcolor{red}{PER}_{ijt} = & PER_{ijt-1} + \beta_0 + \beta_1 LQR_{ijt} + \beta_2 CRD_{ijt} + \beta_3 DEP_{ijt} \\ & + \beta_4 CAS_{ijt} + \beta_5 LEV_{ijt} + \beta_6 BSZ_{ijt} + \beta_7 LQRCRD_{ijt} \\ & + \beta_8 DISdummy_{ijt} + \beta_9 INF_{jt} + \beta_{10} GDP_{jt} + \eta_i + \lambda_t \\ & + \varepsilon_{ijt} \end{aligned}$$

The study will employ a dynamic panel data model due to the nature of the data. Meanwhile, the major problem of endogeneity has to be addressed in this kind of study, through the methodology, due to the possibility of reverse causality as the dependent variable can predict the independent variables on the right-hand side of the model Baltagi, (1995). Moreover, previous year bank performance (PER_{ijt-1}) can affect current year performance (PER_{ijt}) which justifies the use of dynamic panel model specification. The subscript i, j, and t stand for bank, country, and time respectively. The study would use the two-step system GMM in making statistical inferences of the analysis due to the nature of the data and its advantages over the ordinary least square technique of providing more

consistent findings and capable of addressing endogeneity problems among the variables (Yahaya, Mahat, & Matemilola, 2020).

3.2 Variable Description

The study aim at assessing the joint effect of credit and liquidity risk on banks' performance in Sub Saharan Africa. Two measures of bank performance are employed in the study, that is return on Asset (ROA) and net interest margin (NIM). The main independent variables are liquidity risk (LQR), credit risk (CRD), and the interaction term between liquidity and credit risk (LQRCRD). Other bank-specific variables included in the study are deposit ratio (DEP), capital asset ratio (CAS), leverage ratio (LEV), bank size (BSZ), and a deposit insurance scheme (DIS dummy). The macroeconomic variables include inflation (INF) and gross domestic product (GDP). The variables are defined in the below table;

Table I: Variable Description and Definition

Variable	Definition	Code
Dependent		
Return on Asset		ROA _{ijt}
Net Interest Margin	The bank's net profit after tax divided by total asset Net interest margin is the net interest income to total asset ratio	NIM _{ijt}
Independent		
Liquidity Risk	Loan to Deposit Ratio	LQR _{ijt}
Credit Risk	Proportion of Non-Performing Loans to Total Loans	CRD _{ijt}
Bank Specific		
Deposit Ratio	Proportion of total deposit to total asset	DEP _{ijt}
Capital Asset Ratio	Proportion of Total Capital to Total Asset	CAS _{ijt}
Leverage	Total Debt to Total Capital	LEV _{ijt}
Bank Size	log of Total Asset	BSZ _{ijt}
DISdummy		DISdummy _{ij} t
	1, if it explicit deposit insurance scheme, 0 otherwise	
Macro Economic Level		
Inflation	Annual consumer price index percent	INF _{jt}
Gross Domestic Product	GDP growth rate in percent	GDP _{jt}

Source: Author Compilation, 2020

4. Result and Discussion

4.1 Descriptive Statistics

This study covers a period of 9 years from 2010-2018, comprising a total of 450-year observations. ROA and NIM are the two dependent variables with a mean of 2.7078 and 8.9569, with a standard deviation of 1.7007 and 7.0302 respectively. LQR has the highest mean and standard deviation value with 82.0814 and 25.6191 respectively. The mean distribution of other variables that include CRD, DEP, CAS, LEV, and BSZ is 5.3045, 66.1834, 19.6047, 39.9072, and 18.6784 respectively. The macroeconomic variable that includes GDP and INF has a mean value of 9.2171 and 4.7577 with a standard deviation of 3.9851 and 2.9088 respectively.

Table II: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA _{ijt}	450	2.7078	1.7007	-2.5218	9.9701
NIM _{ijt}	450	8.9569	7.0302	-0.5600	91.3510
LQR _{ijt}	450	82.0814	25.6191	-0.6486	150.347
CRD _{ijt}	450	5.3045	6.3047	0.0200	69.3302
DEP _{ijt}	450	66.1834	17.6976	4.8110	158.7518
CAS _{ijt}	450	19.6047	5.9976	3.6901	42.8710
LEV _{ijt}	450	39.9072	23.3794	-171.8700	170.5221
BSZ _{ijt}	450	18.6784	2.7082	12.5874	22.6219
INF _{jt}	450	9.2171	3.9851	3.4945	17.8697
GDP _{jt}	450	4.7577	2.9088	-1.6169	14.0471

Source: STATA 15 Result

4.2 Correlation Matrix

The relationship between the two dependent variables in the study that is ROA and NIM is 0.2246. The main independent variable that comprises LQR and CRD both maintain a negative association with the dependent variable. LQR maintains a negative association with ROA and NIM with the coefficient of -0.1568 and -0.0562. CRD maintains a co-efficient of -0.0570 and -0.1257 for ROA and NIM respectively. The relationship between the two independent variables, that is LQR and CRD is -0.1637.

Other bank-specific maintains both negative and positive relationship with the dependent as well as the independent variables. DEP and CAS maintain a negative association with ROA with 0.1933 and 0.1276 respectively, while the relationship between DEP and NIM is negative while that of CAS and NIM is positive. Likewise, LEV and BSZ maintain a negative association with ROA and NIM. The interaction term LQRCRD maintains a negative relationship with both ROA and NIM with -0.1742 and -0.0889, whereas it maintains a positive relationship with the main independent variable, with 0.2681 and 0.7921 for LQR and CRD respectively.

The macroeconomic variable maintains both positive and negative relationships with the dependent and independent variables in the study. INF maintains a negative association for both ROA and NIM with -0.0060 and -0.0427 respectively. It maintains a co-efficient of -0.2661 and 0.1712 for LQR and CRD respectively. The interaction term has a positive association with INF with 0.0981. GDP also maintain both positive and negative relationship with other variables in the study. GDP maintains a positive association with ROA and NIM with 0.2719 and 0.04226 respectively. The relationship between GDP and LQR is negative with -0.2941 while it maintains a 0.0066 co-efficient with CRD. The interaction term maintains a negative association with a coefficient of -0.0777 with GDP.

Table III: Correlation Matrix

	ROA_{ijt}	NIM_{ijt}	LQR_{ijt}	CRD_{ijt}	DEP_{ijt}	CAS_{ijt}	LEV_{ijt}	BSZ_{ijt}	LQRCRD_{ijt}	INF_{ijt}	GDP_{ijt}
ROA _{ijt}	1										
NIM _{ijt}	0.2246	1									
LQR _{ijt}	-0.1568	-0.0562	1								
CRD _{ijt}	-0.0570	-0.1257	-0.1637	1							
DEP _{ijt}	0.1933	-0.0573	-0.1370	0.0259	1						
CAS _{ijt}	0.1276	0.1611	0.2372	0.0494	-0.1038	1					
LEV _{ijt}	-0.2004	-0.1269	0.1862	-0.0172	-0.1659	-0.0555	1				
BSZ _{ijt}	-0.3008	-0.0082	0.2681	-0.0265	0.1359	0.0831	0.0883	1			
LQRCRD _{ijt}	-0.1742	-0.0889	0.2361	0.7921	-0.0689	0.1881	0.0553	0.1092	1		
INF _{ijt}	-0.0060	-0.0427	-0.2661	0.1712	-0.0201	0.1899	-0.0188	-0.0908	0.0981	1	
GDP _{ijt}	0.2719	0.0426	-0.2941	0.0066	0.0496	-0.0044	-0.1747	-0.3350	-0.0777	-0.1637	1

Source: STATA 15 Result

4.3 Multicollinearity Test

The distribution of the data shows the absence of multicollinearity among the variables because the mean VIF is less than 10. In other words, the VIF and the tolerance value of the explanatory variables show that all the variables have less than 5, and the tolerance level greater than 0.10 respectively.

Table IV: Multicollinearity test

Variable	VIF	1/VIF
LQRCRD _{ijt}	4.47	0.223817
CRD _{ijt}	4.25	0.235482
LQR _{ijt}	2.15	0.465637
GDP _{jt}	1.37	0.732269
INF _{jt}	1.32	0.756728
BSZ _{ijt}	1.25	0.799181
CAS _{ijt}	1.21	0.823661
DEP _{ijt}	1.11	0.897283
LEV _{ijt}	1.1	0.911741
DISdummy _{ijt}	1.09	0.921118
Mean VIF	1.93	

Source: STATA 15 Result

4. 4 Regression Result

4.4. 1 First Regression Result

The study evaluates the joint effect of liquidity and credit risk on the performance of banks from Sub Saharan Africa region. The regression presents four models; the pooled OLS, fixed effect, differenced, and system GMM. The inference for the study will be based on the system GMM due to its ability to address the endogeneity problem found in the ordinary least square estimates and the provision of consistent findings.

The lagged dependent of all the models are significant at 1 percent. This confirms that our model is dynamic and our choice for the system GMM is appropriate. LQR is significant at 1 percent and negatively associated

with ROA. This indicates that an increase in the rate of LQR decreases the ROA, this is consistent with the findings of (Ali & Puah, 2019). CRD is significant at 1 percent and negatively associated with ROA. An increase in the credit risk rate decreases the performance of banks in terms of their return on asset, this is in line with the result obtained by (Partovi & Matousek, 2019). DEP is positively significant at 1 percent. This implies that the deposit ratio moves in the same direction as the performance of banks. A rise in deposit ratio leads to a corresponding increasing in the banking performance, this confirms the findings of (Hoffmann, 2011). CAS is significant at 1 percent and positively associated with ROA. An increase in capital asset ratio increases the bank's ROA.

LEV is significant at 1 percent and positively correlates with the performance of banks, this is consistent with the result obtained by (Aebi, Sabato, & Schmid, 2012; Varotto & Zhao, 2018). BSZ is negatively associated with the performance of banks and significant at 1 percent. This indicates, that an increase in the size of banks negatively affects their performance, this is in line with the findings obtained by (Kasman, Tunc, Vardar, & Okan, 2010; Luo, Tanna, & Vita, 2016). The interaction term LQRCRD is significant at 1 percent and negatively correlates with the performance of banks in terms of their ROA in Sub Saharan Africa. DIS that represents deposit insurance scheme is positive and significant at 1 percent. This shows that the presence of deposit insurance scheme improves banking performance in Sub Saharan African region, this is consistent with the result obtained by (Anginer, Demirguc-Kunt, & Zhu, 2014; Bonner, Lelyveld, & Zymek, 2014).

The macroeconomic variable in the study comprising of INF and GDP are positively associated with banking performance and significant at 1 percent. This shows that an increase in either INF or GDP, or both increase the performance of the banks in terms of their return on asset, this confirms the result obtained by (Dietrich & Wanzenried, 2011; Goddard, Liu, & Molyneux, 2010).

Table V: First Regression Result

VARIABLES	(1) Pooled OLS	ROA (2) Fixed Effect	(3) Differenced GMM	(4) System GMM
ROA _{ijt-1}	0.8880*** (0.02051)	0.6462*** (0.03592)	0.5161*** (0.01160)	0.6160*** (0.00561)
LQR _{ijt}	0.0025 (0.00181)	-0.0035 (0.00340)	-0.0017*** (0.00012)	-0.0111*** (0.00120)
CRD _{ijt}	0.0181* (0.00979)	0.0049 (0.01170)	-0.0016* (0.00091)	-0.0037*** (0.00061)
DEP _{ijt}	0.0021 (0.00187)	0.0080* (0.00425)	0.0072*** (0.00159)	0.0075*** (0.00095)
CAS _{ijt}	0.0053 (0.00586)	0.0155* (0.00913)	0.0193*** (0.00183)	0.0328*** (0.00224)
LEV _{ijt}	-0.0007 (0.00142)	0.0005 (0.00175)	0.0031* (0.00157)	0.0065*** (0.00044)
BSZ _{ijt}	-0.0005 (0.01340)	-0.1240** (0.05791)	-0.3271*** (0.05750)	-0.1290*** (0.00667)
LQRCRD _{ijt}	-0.0005*** (0.00017)	-0.0001 (0.00020)	-0.0016*** (0.00011)	-0.0002*** (0.00007)
DISdummy _{ijt}	-0.1881** (0.07890)	-0.1100 (0.09461)	0.0318* (0.01910)	0.0644*** (0.02181)
INF _{jt}	-0.0093 (0.00926)	0.0104 (0.01270)	-0.0102*** (0.00260)	0.0209*** (0.00234)
GDP _{jt}	0.0159 (0.01330)	0.0426** (0.01792)	0.0283*** (0.00656)	0.0865*** (0.00365)
Constant	0.0122 (0.361)	2.434* (1.285)		
Observations	400	400	350	400
R-squared	0.869	0.567		
Number of code		50	50	50
<i>Diagnostic Test</i>				
Mean VIF	1.91			
No. of Instrument			38	45
AR(1): P-Value			0.1056	0.1058
AR(2): P-Value			0.8050	0.6927
Sargan test: P-Value			0.1944	0.1902

Source: STATA 15 Result

Robust Standard errors in parentheses

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

The post estimation test is conducted. The Arellano and Bond test for first and second-order autocorrelation is conducted. The result revealed an absence of an autocorrelation problem in both the first-order AR [1] and the second-order AR [2]. The Sargan test of instrument validity revealed an insignificant P-value, which implies that the instrument used in the study are valid.

4.4.2 Second Regression Result

The regression result examines the joint effect of liquidity and credit risk on banking performance. Four models are also presented here that include; pooled OLS, fixed effect, differenced, and system GMM. The inference of the study is based on the system GMM. The lagged dependent of all the models are significant at 1 percent, this indicates that our model is dynamic and the choice of the system GMM is relevant. The main independent variables, comprising of LQR and CRD, are both negative and significantly associated with the performance of banks in SSA. An increase in each rate of liquidity risk or credit risk decreases the banks return on asset, this finding is consistent with that of (Ghenimi et al., 2017).

Other bank-specific variables are also explained. DEP is not significant in this model. CAS is negative and significant at 1 percent, this is consistent with the result obtained by (Varotto & Zhao, 2018). LEV is positive and significant at 1 percent, this is in line with the result obtained by (Bostandzic & Weiß, 2018). BSZ is significant and negatively associated with banking performance. This implies that an increase in the size of the banks, decreases the performance of the banks, this confirms the findings of (Ghenimi et al., 2017; Waemustafa & Sukri, 2015). Our interaction term LQRCRD is significant at 1 percent and negatively related to the performance of banks in the SSA region. DIS is positive and significant. This indicates that an increase in bank performance if there is a presence of deposit insurance scheme practice in the country, this is consistent with (Ioannidou & Fabiana, 2010). The macroeconomic variables, INF and GDP are both positive and significant. This implies improve performance of banks with every increase in either or both of the macroeconomic variables in the model, this result is in line with what is obtained (Albertazzi & Gambacorta, 2009; Molyneux & Thornton, 1992).

Table VI: The Second Regression Result

VARIABLES	(1) Pooled OLS	NIM (2) Fixed Effect	(3) Differenced GMM	(4) System GMM
NIM _{ijt-1}	0.8140*** (0.03330)	0.6381*** (0.04220)	0.8030*** (0.07450)	0.5633*** (0.00730)
LQR _{ijt}	-0.0034 (0.01311)	-0.0009 (0.02590)	-0.0016*** (0.00010)	-0.0203** (0.00849)
CRD _{ijt}	-0.0115 (0.07000)	0.0629 (0.08990)	0.0423 (0.04391)	-0.0697*** (0.01442)
DEP _{ijt}	0.0010 (0.01300)	-0.0321 (0.03281)	-0.0402*** (0.01520)	0.0132 (0.00893)
CAS _{ijt}	0.0502 (0.04116)	0.0201 (0.06905)	0.0849*** (0.02510)	-0.0629*** (0.01031)
LEV _{ijt}	0.0036 (0.01011)	0.0178 (0.01350)	0.0176*** (0.00210)	0.0084*** (0.00218)
BSZ _{ijt}	-0.0046 (0.09161)	-0.8790** (0.4460)	0.2081** (0.10000)	-0.9452*** (0.07390)
LQRCRD _{ijt}	-0.0012 (0.00119)	-0.0020 (0.00151)	-0.0022*** (0.00076)	-0.0037*** (0.00038)
DISdummy _{ijt}	-0.0004 (0.56201)	-0.2350 (0.72800)	1.2821*** (0.16611)	0.3610*** (0.13701)
INF _{jt}	-0.0346 (0.06641)	-0.1120 (0.09930)	0.1230*** (0.02271)	0.0623*** (0.01740)
GDP _{jt}	0.0173 (0.09421)	-0.2100 (0.14000)	-0.1191*** (0.03750)	0.0832*** (0.01181)
Constant	1.700 (2.574)	23.54** (9.981)		
Observations	400	400	350	400
R-squared	0.648	0.438		
Number of code		50	50	50
<i>Diagnostic Test</i>				
Mean VIF	1.91			
No. of Instrument			38	45
AR(1): P-Value			0.2285	0.0083
AR(2): P-Value			0.1927	0.3117
Sargan test: P-Value			0.2342	0.3302

Source: STATA 15 Result Robust standard errors in parentheses

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

The diagnostic test is conducted and reported. The Arellano and Bond first and second-order test for autocorrelation is conducted. The result revealed a presence of first-order AR [1] and absence of second-order AR [2] autocorrelation, in overall, an absence of autocorrelation problem is confirmed in the model. The Sargan test of instrument validity reported an insignificant P-value, which implies that the instrument used in the study are valid.

4.5 Discussion of the Main Findings and Hypotheses testing

The study's main objective is to evaluate the interaction or joint effect of liquidity risk and credit risk on the performance of banks in Sub Saharan Africa region. The interaction term LQRCRD shows a negative and significant relationship with the performance of banks in the SSA region. This implies that an increase in the rate of LQRCRD decreases the performance of banks in the region. The result further revealed a significantly negative association with bank performance in the SSA region. Moreover, the result of credit risk shows a significant and negative association with bank performance. Each of the risks affects bank performance negatively.

The hypotheses postulated are all supported by the result of the study. The first hypothesis which states a significant negative relationship between liquidity risk and bank performance in the SSA region is supported by the result. This confirms that liquidity risk negatively affects bank performance. The second hypothesis is also supported. This also confirms a significant negative relationship that exists between credit risk and bank performance. The third hypothesis is also supported. The relationship between liquidity risk and credit risk is positive, this means they move in the same direction either increase or decrease. In this case, they jointly decrease.

4.6 Robustness Check

The robustness model adjusts the baseline model. First, the dependent variable that is earnings per share (EPS), is different from the ones used in the main models, as used by (Al-Sartawi, 2018). Another adjustment made is the replacement of CAS with CAR, and RC dummy replaces DIS dummy. The aim is to test for the robustness of the result in our main models. The analyses present four models that include the pooled OLS,

fixed effect, differenced GMM, and system GMM. The study object is to test the influence of the interaction effect of liquidity and credit risk on the performance of banks in Sub Saharan Africa. All lagged dependent in the model are significant, this implies the dynamic nature of our models and the justification in using the system GMM approach for the inference.

LQR is found to be significant at 1 percent and negatively relates to EPS. Likewise, CRD is significant at 1 percent and negatively associate with EPS. This means that both risks are negatively significant and their increase, decreases the performance of banks. Other bank-specific variables are also explained. DEP is positive and significant 1 percent, this is consistent with the result obtained by (Hoffmann, 2011). CAR is positive and significant at 1 percent, this is consistent with the findings obtained by (Abou-El-Sood, 2016). Likewise, LEV is positive but significant at 5%, this confirms the result obtained by (Ippolito, Peydró, Polo, & Sette, 2016). This indicates that a rise in the rate of each DEP, CAR, and LEV lead to an increase in the performance of banks in the Sub Saharan African region. BSZ is significant at 1 percent and negatively relates with EPS. This implies that an increase in the size of banks in the SSA region decreases the performance of the banks, this is consistent with the findings of (Ghenimi et al., 2017; Kasman et al., 2010).

The interaction term LQRCRD is significant at 1 percent and negatively associated with the performance of banks in the SSA region. Risk committee is found to be positively significant, which means the presence of risk committee increase the banks performance rate in the region, this is consistent with the result obtained by (Azim, Jubb, & Nahar, 2016; Battaglia & Gallo, 2015). The macroeconomic variables also have some impact on the performance of banks. INF is positively significant affects banking performance positively, this is in line with the findings of (Doumpos, Gaganis, & Pasiouras, 2015). GDP is equally found to be significant and positively related to the performance of banks in the SSA region, this is consistent with the result obtained by (Dewandaru, Nagayev, Ng, Nizam, & Nkoba, 2019).

Table VI: Regression Result for Robustness Check

VARIABLES	(1) Pooled OLS	EPS (2) Fixed Effect	(3) Differenced GMM	(4) System GMM
EPS _{ijt-1}	0.8192*** (0.03280)	0.4160*** (0.04761)	0.8981*** (0.00136)	0.1430*** (0.00175)
LQR _{ijt}	0.0176 (0.01470)	-0.0151 (0.02721)	-0.0384*** (0.00382)	-0.0513*** (0.00226)
CRD _{ijt}	0.0547 (0.07981)	0.0295 (0.09590)	-0.0360** (0.01451)	-0.1121*** (0.01150)
DEP _{ijt}	0.0137 (0.01490)	-0.0241 (0.03410)	0.0004 (0.00457)	0.0740*** (0.00316)
CAR _{ijt}	-0.0039 (0.01371)	-0.0439 (0.02832)	-0.0023 (0.00245)	0.0626*** (0.00234)
LEV _{ijt}	-0.0115 (0.01150)	0.0008 (0.01451)	0.0017 (0.00253)	0.0031** (0.00142)
BSZ _{ijt}	0.1560 (0.10900)	1.1561** (0.49501)	0.8870*** (0.24800)	0.3881*** (0.01971)
LQRCRD _{ijt}	-0.0019 (0.00137)	-0.0019 (0.00161)	-0.0019*** (0.00018)	-0.0048*** (0.000179)
RCdummy _{ijt}	-1.0461 (0.83301)	-1.1512 (0.90110)	-0.1631** (0.07271)	-0.9932*** (0.0606)
INF _{jt}	-0.1841** (0.07791)	-0.2700** (0.11801)	0.0767*** (0.01200)	0.3011*** (0.00862)
GDP _{jt}	-0.1000 (0.11510)	-0.3001* (0.17500)	0.1300*** (0.01721)	0.3210*** (0.01260)
Constant	0.278 (3.279)	-8.595 (10.43)		
Observations	400	400	350	400
R-squared	0.706	0.269		
Number of code		50	50	50
Mean VIF	1.91			
No. of Instrument			39	46
AR(1): P-Value			0.1120	0.0705
AR(2): P-Value			0.3297	0.3739
Sargan test: P-Value			0.1655	0.1542

Source: STATA 15 Result Robust standard errors in parenthese

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

The diagnostic test was conducted and reported the findings. The Arellano and Bond test for first and second-order autocorrelation was conducted. The result revealed the presence of first-order AR[1] and absence of second-order AR[2] autocorrelation. The Sargan test of instrument

validity reported an insignificant p-value, which indicates that the instrument used in our study is valid.

5. Conclusion and Policy Implications

The paper explains the dominant risk factors in the banking sector and the threat they posed on the banking sector either separately or jointly. The study evaluates the joint effect of liquidity and credit risk on the performance of banks in Sub Saharan Africa. The study employed a two-step generalized method of moment estimation technique to analyze panel data of 50 banks across six SSA countries for 9 years (2010-2018). Both the liquidity risk and credit risk have a negative impact on banks in SSA, so also their joint effect. However, the association between liquidity and credit is positive. The two risks are the major threat to the banking sector of SSA particularly with their interaction effect indicating a negative coefficient that tends to decrease with an increase in banking performance. This underscores the need for the banks to employ all strategies possible to improve their performance in order to keep those threat within the barest minimum.

Findings from the study have many policy implications to the various stakeholders of the banking sector that include; policymakers, bank practitioners, society, and academics. The policymakers learned from the experience of the effect of those risk factors in the banking sector. They are encouraged to come up with sound policies that will minimize the effect of those risks on the overall performance of banks. Bank practitioners have better knowledge of the happenings in the banking sector; they, therefore, feed the policymakers with all the practical solutions that needed to be embraced to have a more resilient banking sector. Society may also find the study useful because it helps them to know the bank to invest to avoid loss of their investment because of the risk affecting banks. The study will also add new knowledge to existing ones, through the new data set coming from developing nations with more investment prospects in the future.

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Is Profitability of Islamic Banks Shaped by Bank-specific Variables, Global Financial Crisis and Macroeconomic Variables?

Hatem Elfeituri¹ and Khaled O. Alotaibi²

ABSTRACT

This study aims to investigate the determinants of Islamic banks' (IBs) profitability. A large sample of IBs from 12 developing countries has been selected for a period (2004-2017) that includes the recent global crisis period (GFC), as well as bank-specific and macroeconomic variables. The paper applies advanced quantitative techniques by using a dynamic generalized method of moments (GMM) compared to the fixed effect models that are widely used within the literature. Findings indicate that asset quality, capital adequacy and non-financial activity play major roles in determining profitability of IBs. Furthermore, findings show that IBs are not affected by the GFC, as they are less exposed to international banks and do not grant subprime loans. Moreover, IBs were able to maintain better capital ratios during the GFC, which shielded them from the severe effects of the crisis. On the other hand, results showed that profitability would be reduced by increases in asset quality, liquidity, and deposit ratio. These findings emphasised that profitability of IBs would be safeguarded if those banks maintained a suitable level of capital adequacy to withstand any financial distress and introduced diverse sources of income. Hence, the findings of this research provide useful insights for IBs' stakeholders including bank management, investors, clients, and policy markets.

ملخص

تهدف هذه الدراسة إلى البحث في محددات ربحية البنوك الإسلامية. فقد تم اختيار عينة ضخمة من البنوك الإسلامية من 12 بلدا ناميا لفترة (2004-2017) تشمل فترة الأزمة المالية العالمية (GFC) الأخيرة، فضلا عن المتغيرات الخاصة بالبنوك والاقتصاد الكلي. وتعتمد الورقة تقنيات كمية متطورة

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من خلال استخدام أسلوب اللحظات المعمم (GMM) الديناميكي بالمقارنة مع نماذج التأثير الثابت المستخدمة على نطاق واسع في الأدبيات. وتشير النتائج إلى أن كل من نوعية الأصول وكفاية رأس المال والنشاط غير المالي تؤدي أدواراً رئيسية في تحديد ربحية البنوك الإسلامية. وعلاوة على ذلك، تبين النتائج أن البنوك الإسلامية لا تتأثر بالأزمة المالية العالمية، لأنها أقل عرضة لمعاملات المصارف الدولية ولا تمنح قروض الرهن العقاري. كما أن البنوك الإسلامية قد تمكنت من الحفاظ على نسب رأسمالية أفضل خلال فترة الأزمة المالية العالمية، الأمر الذي حماها من التداعيات الخطيرة للأزمة. ومن ناحية أخرى، أظهرت النتائج أن الربحية ستُخفض بزيادة نوعية الأصول والسيولة ونسبة الودائع. وشددت هذه النتائج على أن ربحية البنوك الإسلامية ستكون مضمونة إذا حافظت تلك المصارف على مستوى مناسب من كفاية رأس المال لمواجهة أي ضائقة مالية وأدخلت مصادر دخل متنوعة. ومن هنا فإن نتائج هذا البحث توفر لمحات عامة مفيدة لأصحاب المصلحة في البنوك الإسلامية، بما في ذلك إدارة البنوك، والمستثمرين، والعملاء، وأسواق السياسات.

ABSTRAITE

Cette étude vise à examiner les déterminants de la rentabilité des banques islamiques (BI). Un large échantillon de banques islamiques de 12 pays en développement a été sélectionné pour une période (2004-2017) qui inclut la récente période de crise mondiale (GFC), ainsi que des variables macroéconomiques et spécifiques aux banques. Le document applique des techniques quantitatives avancées en utilisant une méthode dynamique généralisée des moments (GMM) par rapport aux modèles à effet fixe qui sont largement utilisés dans la littérature. Les résultats indiquent que la qualité des actifs, l'adéquation des fonds propres et l'activité non financière jouent un rôle majeur dans la détermination de la rentabilité des IB. En outre, les résultats montrent que les BI ne sont pas affectées par la crise financière mondiale, car elles sont moins exposées aux banques internationales et n'accordent pas de prêts à risque. En outre, les BI ont été en mesure de maintenir de meilleurs ratios de capital pendant la crise financière mondiale, ce qui les a protégées des effets graves de la crise. D'autre part, les résultats ont montré que la rentabilité serait réduite par une augmentation de la qualité des actifs, de la liquidité et du ratio des dépôts. Ces résultats soulignent que la rentabilité des BI serait préservée si ces banques maintenaient un niveau approprié de fonds propres pour résister à toute détresse financière et introduisaient diverses sources de revenus. Par conséquent, les résultats de cette recherche fournissent des informations utiles aux parties prenantes des BI, notamment la direction des banques, les investisseurs, les clients et les marchés des politiques.

Keywords: Islamic Banks (IBs), profitability, bank-specific determinants, macroeconomic variables, global crisis period (GFC), generalized method of moments (GMM).

JEL Classification: C23, C26, F36, G21, F62

1. Introduction

Banks play a substantial role in the development of economies, as the performance of the banking sector directly impacts the performance and growth of economies (Khasawneh, 2016). A profitable and healthy banking system improves the stability of a financial system and offers a safeguard against negative shocks (Rashid and Jabeen, 2016). Islamic banks (IBs), particularly, have contributed to economic growth (Sun et al., 2017) and financial stability globally, and in the Middle East economies (Tabash and Dhankar, 2014). IBs represent a significant portion of Muslim countries' banking systems and are growing rapidly over time. IBs increased their market share in the Organization of Islamic Cooperation (OIC) region from almost zero in the 1970s to about 40% in some countries (Sun et al., 2017).

Therefore, this paper is motivated by the significant growth of the IBs. They continued to grow 10–12% per annum, and showed robustness and stability despite the impact of the global financial crisis (GFC) (Beck et al., 2013; Olson and Zoubi, 2016) and other global financial shocks across banking markets such as sovereign debt crisis (Alqahtani et al., 2016). Hence, more interest and attention were given to IBs during and after the GFC (Khasawneh, 2016; Trabelsi and Trad, 2017; Hussien et al., 2019), indicating that IBs represent a different business model compared to conventional commercial banks (CBs). IBs' business model involves the prohibition of Riba (interest), Maysir (games of chance), Gharar (taking excessive risks in contracts), and Haram (unlawful) activities that include unethical business, together with the payment of part of one's wealth to benefit society (Zakat)¹ (Alotaibi et al., 2020). Such models also involve the prohibition of monopolies, extravagance and stinginess, and the promotion of justice, fairness, and honesty (Al-Qaradawi, 2005). Further, IBs' business model suggests a different product structure, as compared to CBs, which has contributed to their unique performance. IBs' product

¹ Zakat is an annual obligatory financial levy on all surplus wealth of Muslims to help the needy; it literally means purification, growth, and blessing (Al-Qaradawi, 2005).

structure involves asset-backed financing instruments (Zeitun, 2012), as they use profit-loss sharing structure of financing and investment. However, there is an ongoing argument about how far this is applied in practice (Effendi, 2018; Yanikkaya et al., 2018).

Despite the surge in the IBs' literature, there are continuing puzzling issues regarding the determinants that explain IBs' profitability a decade after GFC, such as whether they are different from their conventional counterparts, given the fact that the profitability of IBs was challenged few years post-GFC (Alqahtani et al., 2016; Olson and Zoubi, 2016). For instance, Olson and Zoubi (2016) examined the performance of IBs in 22 Middle East and North Africa region (MENA) and South East Asia countries during the period 1996–2014, and report that IBs performed better during the GFC, then (like CBs) became affected in 2009 by the economic downturn.

Consequently, this study expanded the number of years investigated, ultimately comprising the longest period after the GFC between 2004 and 2017 that had yet to be covered by prior literature. This also covers other global financial shocks across banking markets such as sovereign debt crisis and regional political distress in the Middle East. Importantly, this reflects the rapid changes to and interventions in the banking systems in OIC developing countries following recent re-regulations after the GFC.

Moreover, this research combines internal (bank-specific) and external (macroeconomic) variables to estimate the determinants of IBs' profitability. Although IBs are based on ethical and social values, they are required by their owners and depositors to maximize their wealth. Therefore, this study will answer the question: which bank-specific and macro-economic determinants affect the IBs' profitability, pre- and post-the GFC period? Answering this research question helps understanding the significant factors that influence IBs' profitability positively and negatively to maximize the owners' wealth and funds of depositors under different market conditions.

The remainder of the study is structured as follows. The literature review is presented in Section 2. Section 3 describes the methodology and data, while the empirical results are given in Section 4. Finally, Section 5 concludes the study.

2. Literature Review

The performance of banks can be evaluated in terms of profitability, efficiency, liquidity, credit risk performance and solvency, using various variables and statistical techniques (Hanif et al., 2012). Many prior studies have been conducted to analyze the determinants and factors influencing CBs' performance. However, after the GFC, the literature has concentrated more on IBs, distinguished by their different characteristics and principles (Beck et al., 2013; Olson and Zoubi, 2016; Zarrouk et al., 2016; Hussien et al., 2019; Ibrahim, 2020). In addition, due to the rapid growth of IBs in OIC countries, many researchers, and policymakers have been attracted to investigating the underlying issues, challenges and potential for this industry. Hence, research on IBs has been refocused as a priority topic, achieving momentum in banking research based on the distinctive business model of IBs (Rashid and Jabeen, 2016; Sun et al., 2017; Yahya et al., 2017).

There is general agreement in literature that the performance of IBs is superior to CBs (Daly and Frikha, 2017). Studies argue that IBs provide competitive performance while addressing religious and ethical values (Khasawneh, 2016; Alhammadi et al., 2020), even during the GFC period (Čihák and Hesse, 2010; Hasan and Dridi, 2011; Beck et al., 2013; Olson and Zoubi, 2016). Moreover, empirical studies have found that some financial firms have been impacted differently by GFC (Čihák and Hesse, 2010; Hasan and Dridi, 2011; Beck et al., 2013; Tabash and Dhankar, 2014; Alqahtani et al., 2016; Alzoubi, 2018; Hussien et al., 2019). Firms using Islamic financing instruments to finance their operations or not heavily dependent on the interest-based financing were less susceptible to the crisis (see Čihák and Hesse, 2010; Hasan and Dridi, 2011). Further, some have argued that the GFC could have been prevented if Islamic finance was the predominant model, instead of conventional finance (Beck et al., 2013). This is because the practices and risky financial instruments that are believed to be responsible for the GFC, such as mortgaged-backed securities, collateralized debt obligation and credit default swaps are prohibited in Islamic finance (Alqahtani and Mayes, 2017). In addition, IBs were able to maintain better capital ratios than CBs (Bashir, 2003) during the GFC, which shielded the former from the severe effects of the crisis (Chazi and Syed, 2010).

Nevertheless, few other studies have questioned the performance of IBs under different economic conditions, especially post-crisis, and have found inconclusive empirical evidence (see Beck et al., 2013; Alqahtani et al., 2016; Olson and Zoubi, 2016; Hussien et al., 2019). For example, Alqahtani et al. (2016) found that IBs in the Gulf Cooperation Council (GCC) performed well immediately after the crisis but as a result of the economic downturn, their post-crisis performance on a longer span was less effective compared with their conventional counterparts. Similarly, Olson and Zoubi (2016) revealed that IBs in MENA and South East Asian countries performed better during the GFC; then, like CBs, became affected in 2009 by the economic downturn. However, most studies on the performance of IBs were conducted before, during and only a few years post-GFC.

Most banking research was conducted in developed countries, while little evidence was documented in developing countries and on IBs (Zeitun, 2012; Sun et al., 2017). Hence, this section provides a summary of the literature related to the financial performance of IBs in developing countries.

Table 1: Summary of Literature Review

Study	Sample/ Region	Period	Methodology	Main Findings
Bashir (2003)	14 Islamic banks form 8 Middle Eastern countries	1993 - 1998	Regression analysis	IBs' profitability measures respond positively to the increases in capital and loan ratios. The larger equity to total asset ratio and larger loan to asset ratio interacted with GDP lead to higher profit margins. Taxes have a negative effect on banks' profitability. Higher GDP per capita and higher inflation rates have a strong positive impact on the performance measures.
Čihák and Hesse (2010)	19 banking systems in OIC countries	1993-2004	Panel regression models	Small IBs are financially stronger than small CBs; large CBs are financially stronger than large IBs; and small IBs are financially stronger than large IBs
Asma et al. (2011)	9 IBs in Malaysia	2007-2009	Generalized Least Square (GLS) panel data analysis	Only the bank size is significant in determining the profitability with positive relationship. While, capital adequacy, liquidity, credit risk and expenses management were insignificant.

Study	Sample/ Region	Period	Methodology	Main Findings
Hanif et al. (2012)	22 CBs and 5 IBs in Pakistan	2005-2009	Financial ratios analysis and questionnaire	IBs leads in terms of credit risk management and solvency maintenance but underperform CBs in terms of profitability and liquidity.
Masood and Ashraf (2012)	25 IBs from 12 countries	2006-2010	panel data	Banks size, capital adequacy, loans to assets and assets management results leads to positive and significant relationship with IBs profitability. Nonperforming loans, gearing ratio, are negatively related to profitability. Liquidity, deposits and operating efficiency, inflations have less effect on profitability.
Zeitun (2012)	38 CBs and 13 IBs in GCC countries	2002-2009	panel data	Bank size has a positive significant influence on IBs' performance as measured by ROE. GDP is positively correlated to bank's profitability, while inflation is negatively correlated to bank's profitability.
Beck et al. (2013)	510 banks across 22 countries, 88 of which are IBs	1995–2009	Regression (fixed effect)	IBs are less cost-effective but have higher asset quality and are better capitalized. They found large variation cross-country in the differences between conventional and IBs as well as across IBs of different sizes. During crisis, IBs are better capitalized, with lower loan losses.
Alqahtani et al.(2016)	101 banks from 6 GCC countries	1998–2012	Regression -	IBs performed better than CBs in terms of capitalisation, profitability and liquidity during the early stages of the GFC but worse later as a result of the economic downturn. IBs may have avoided the consequences of volatile financial instruments, but they were not immune to major economic recession.
Khasawneh (2016)	61 IBs, 207 CBs in MENA countries	2006 - 2013	Regression And Z-score index to measure stability	Profitability and stability determinants of IBs and CBs are different. The results show that IBs are more profitable than CBs, while CBs are more stable. The larger banks are more stable than smaller banks, and off-balance sheet activities increase banks' vulnerability for both IBs and CB. Both IBs and CB are affected by the financial crises in terms of profitability and stability.

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Study	Sample/ Region	Period	Methodology	Main Findings
Rashid and Jabeen (2016)	5 IBs and 17 CBs in Pakistan	2006-2012	GLS regression	Operating efficiency, deposits, and market concentration are significant in explaining performance of IBs, while operating efficiency, reserves, and overheads are significant determinants of CBs performance. Bank size positively but statistically insignificantly related performance. The impact of GDP and the lending interest rate on performance is negative for both types of banks.
Olson and Zoubi (2016)	MENA and South East Asia, 22 countries	1996–2014	Regression (fixed effect)	IBs performed better during the GFC, then became affected in 2009 because of the economic downturn like CBs. However, the GFC has differentially impacted various countries and regions such as such as the Southeast Asia region.
Zarrouk et al. (2016)	51 IBs in MENA countries	1994-2012	GMM	Profitability of IBs is positively affected by banks' cost-effectiveness, asset quality and level of capitalization. Non-financing activities allow IBs to earn higher profits. IBs' profitability measures respond positively to an increase in GDP and investments but negatively to inflation rates. Profitability determinants did not differ significantly between IBs and CBs.
Daly and Frikha (2017)	12 banks (6 IBs and 6 CBs) in Bahrain	2005-2009	Data Envelopment Analysis (DEA)	The increase of IBs' size and the rapid growth in the customers' deposits are the important factors of performance. Government interventions have a negative impact on the banking performance.
Trabelsi and Trad (2017)	94 IBs in 18 GCC and South East Asian countries	2006-2013	GMM and Z-score to measure stability	Bank capital is the main indicator that contributes to maximizing profitability and stability of IBs and reducing their credit risk. But liquidity and asset quality determinants lead to inconclusive results. GCC IBs are more profitable, more solvent and less risky than those operating in the South East Asian region. No significant relationship between inflation rate and IBs profitability.

Study	Sample/ Region	Period	Methodology	Main Findings
Sohel et al. (2019)	Using data from a sample of 20 countries	2000 - 2015	Regression Using fixed effect	IBs, as compared to CBs, have a greater dependence on fee than returns from loans to increase their profitability. They show that measures such as loan to deposit ratio may affect the profitability of IBs less significantly than CBs and contribute to lower credit risk.
Sun et al. (2017)	66 CBs and 39 IBs in 15 OIC countries	1997–2010	GMM	The profit margin of the IBs and CBs differs significantly, but overall IBs are not different in behaviour or dynamics from CBs as they both compete traditionally (borrowing & lending) to meet funding demands. Capital adequacy, management quality, and diversification determinants significantly explain the margins of both types of banks.
Alzoubi (2018)	42 IBs and 26 CBs from 13 MENA countries	2006 to 2016	Using fixed effect panel data analysis	IBs is significantly positively affected by the bank size, the capital adequacy ratio and the size of customers' deposits, significantly negatively affected by investments in securities, but insignificantly affected by loans and cash held
Yanikkaya et al. (2018)	74 IBs and 354 CBs in OIC and UK	2007 - 2013	GMM fixed effect	Profitability measures are not persistent over time and neither of them has significant relationship with the country specific macroeconomic variables.
Hussien et al. (2019)	30 IBs in 5 GCC countries (Oman excluded)	2005 - 2011	Regression, fixed and random effect. Chi-square test Panel data	IBs is significantly impacted by bank size, capital adequacy, inflation rate, credit risk, financial risk, and liquidity. They find a structural change before and after the GFC.
Ibrahim (2020)	21 CBs and 16 IBs in Malaysia	2003 to 2015	panel-data modelling method	IBs are less profitable than CBs. However, the increasing presence of Islamic banking appears to make Malaysian banks less risky and, with limited evidence, more efficient.

NOTE: IBs, Islamic banks; CB, conventional bank; GDP, gross domestic product; DEA, data envelopment analysis; GCC, Gulf Cooperation Council, OIC; Organization Islamic Cooperation; MENA, Middle East and North Africa region; GMM, generalized method of moment; GFC, global financial crisis.

Table 1 summarizes the relevant empirical literatures that have investigated the performance of IBs. As shown in table 1, empirical studies have examined the performance of IBs in different developing countries, some of which were conducted within a single-country setup while other studies have concentrated on a panel of countries. For example, evidence drawn from specific countries such as: Malaysia (Asma et al., 2011), Pakistan (Hanif et al., 2012; Rashid and Jabeen, 2016), Bangladesh (Miah and Sharmeen, 2015), Indonesia (Hardianto and Wulandari, 2016), Bahrain (Daly and Frikha, 2017), Yemen (Yahya et al., 2017). Other studies looked at a wider group of countries such as GCC countries (Zeitun, 2012; Alqahtani et al., 2016; Hussien et al., 2019), MENA countries (Khasawneh, 2016; Zarrouk et al., 2016; Olson and Zoubi, 2016), OIC countries (Cihák and Hesse, 2010; Masood and Ashraf, 2012; Sun et al., 2017; Yanikkaya et al., 2018).

Some former studies compared the profitability of both IBs and CBs (Hanif et al., 2012; Alqahtani et al., 2016; Khasawneh, 2016; Daly and Frikha, 2017; Sun et al., 2017; Alzoubi, 2018; Yanikkaya et al., 2018), whereas other studies focused only on IBs (Asma et al., 2011; Masood and Ashraf, 2012; Zarrouk et al., 2016; Trabelsi and Trad, 2017; Yahya et al., 2017; Hussien et al., 2019).

Most of the previous studies used either return on equity (ROE), return on assets (ROA) or both ratios as dependent variables to measure banks' profitability (Bashir, 2003; Asma et al., 2011; Masood and Ashraf, 2012; Yanikkaya et al., 2018; Hussien et al., 2019), while few other studies use net profit margin (NPM) (e.g. Sun et al., 2017). Regarding the independent variables, various studies determined the significance of several internal (bank specific) or macro-economic variables (or both) in explaining bank profitability. The most common internal factors identified in the literature are the asset quality, capital strength, the deposit level, the loans ratio, the risk level and banks' costs and size.

Employing a sample group of countries, Zarrouk et al. (2016), for instance, examined the variables that determine the profitability of 51 IBs in MENA countries from 1994-2012. They found that profitability of IBs is positively affected by banks' asset quality and level of capitalization. This finding aligned with Bashir (2003), Beck et al. (2013) and Sun et al. (2017) but was inconsistent with Trabelsi and Trad (2017) and Alzoubi (2018), who found that asset quality led to inconclusive results as a

determinant of profitability. Sun et al. (2017) report that capital adequacy, quality management, and diversification determinants significantly explain the margins of both IBs and CBs in OIC countries over the period 1997-2010. In contrast, Trabelsi and Trad (2017), who examined the performance of IBs in GCC and South East Asian countries over the period 2006-2013, find that asset quality and liquidity determinants lead to inconclusive results, but bank capital is the main indicator that contributes to maximizing profitability of IBs and reduces their credit risk. This confirms the finding of Bashir (2003), who shows that adequate capital ratios play a practical role in explaining the performance of IBs. Hence, regulators may use this as evidence for prompt supervisory action.

Further, Zarrouk et al. (2016), like Masood and Ashraf (2012), pointed out that the non-financing activities allow IBs to earn higher profits.

Besides, Zeitun (2012) studied the performance of IBs and CBs operating in GCC countries over the 2002-2009 period. The author discovered that bank size has a positive significant influence on IBs' performance in line with the findings of Asma et al. (2011), Masood and Ashraf (2012), Daly and Frikha (2017), Alzoubi (2018), but opposed to Rashid and Jabeen (2016), who indicate that bank size has insignificant impact on bank profitability. On other hand, Čihák and Hesse (2010) found that small IBs are financially stronger than large IBs.

Measuring the asset quality, Bashir (2003), Masood and Ashraf (2012) documented that the loan to assets ratio is positively related to profitability. In addition, Masood and Ashraf (2012) report that the ratio of non-performing loans (NPLs); loans under follow-up to total assets (describing the capital situation of banks' loans portfolio) is related negatively to performance, as cyclical behaviour of NPLs leads to a decrease in banks' asset value and earnings quality (Arham et al., 2020).

Using data from a sample of 20 countries for the period from 2000 to 2015, Soheli et al. (2019) report that the IBs, as compared to CBs, depend more on fee than returns from loans to increase their profitability. They show that measures such as loan to deposit ratio may affect the profitability of IBs less significantly than CBs, and contribute to lower credit risk. Arham et al. (2020) report that NPLs are an important credit risk in Emerging Asia banks. They point to the role of country governance

in mitigating the negative effects of macroeconomic variables on bank credit risk.

Therefore, many studies examined external factors. For instance, Hussien et al. (2019) affirm that GDP and inflation are important factors in explaining IBs' performance, as the authors indirectly explain the impact of financial crisis due to international interdependence. Bashir (2003), Zeitun (2012) and Zarrouk et al. (2016) show that IBs' profitability measures respond positively to an increase in GDP but negatively to inflation rates. Correspondingly, Rashid and Jabeen (2016) highlight the impact of GDP and lending interest rate on banks' performance. Nevertheless, Yanikkaya et al. (2018) find that the profitability of IBs is insignificantly related to most of the macroeconomic variables used in the analysis. Further, Bashir (2003) reports that taxes have a negative effect on banks' profitability. Hence, Daly and Frikha (2017) highlight that government intervention has a negative impact on the banking performance.

As shown in Table 1, some studies concluded that the determinants of profitability for IBs are different from those for CBs, inferring that the profitability of IBs relies on the different dynamics (Beck et al., 2013; Olson and Zoubi, 2016; Khasawneh, 2016; Yanikkaya et al., 2018). For instance, Khasawneh (2016) reports that the profitability and stability determinants of IBs and CBs in MENA countries varied over the period 2006-2013. Khasawneh's results show that IBs are more profitable than CBs, while the latter are more stable. On the other hand, Ibrahim (2020) finds that IBs in Malaysia were less profitable than their conventional counterparts during the period 2003 to 2015. Nevertheless, despite lower profitability, Ibrahim (2020) highlights the positive spillover effects of IBs' presence on bank risk and, to a limited extent, bank efficiency.

To enhance the profitability of IBs, Yanikkaya et al. (2018) highlight the importance of new product and alternative channel development, especially products that promote more risk sharing as compared to the products based on Murabahah (debt based) structure. Conversely, other studies have shown that the profitability determinants do not differ significantly between IBs and CBs (Sun et al., 2017; Zarrouk et al., 2016), suggesting that there is evidence of several similarities between the determinants of the profitability for IBs and CBs.

After reviewing the literature, and as presented in table 1, the empirical conclusions of the previous studies are mixed, and differ significantly. This is due to the variation in data, time periods, countries' context, and statistical methods employed in the analyses.

Therefore, this paper contributes to the existing IBs literature in different ways to fill the gaps. First, it provides recent data and analysis on IBs in a wide group of countries, including GCC, MENA and South East Asian regions. Second, it covers a long period of time, ensuring enough spread of years pre- and post- GFC. Third, the study applies advanced quantitative techniques by using a dynamic generalized method of moments (GMM) compared to the fixed effect models commonly used within the literature. Furthermore, this study uses asset ROA, ROE and NPM as measures of IBs profitability to examine whether the profitability of IBs is driven by the same variables as CBs specifically, analyzing how bank-specific characteristics and macroeconomic factors affect the profitability of IBs.

3. Data and Methodology

This paper uses panel data of 45 fully-fledged IBs collected from 12 Muslim-majority countries that are members of the OIC, namely Saudi Arabia, Kuwait, United Arab Emirates, Bahrain, Oman, Qatar, Jordan, Turkey, Pakistan, Malaysia, Bangladesh, and Indonesia, over a period of 14 years ranging from 2004 to 2017. These developing countries were chosen based on the availability of data and the importance of IBs in their banking system. They are from different regions, namely GCC and the Middle East, East Asia, and South Asia. IBs in all these countries operate in dual-type banking systems, where both IBs and CBs function at the same time in the financial system.

The examined variables were gathered via DataStream and the World Bank outlook to cover bank-specific variables, macroeconomic variables; and dummy variables were created to capture the effect of financial crisis on the financial performance of IBs.

3.1 Variables

3.1.1 Dependent Variables

The banking literature uses return on asset (ROA), return on equity (ROE) and net profit margin (NPM) as measures of profitability for banks, as shown in table 1 (Masood and Ashraf, 2012; Zarrouk et al. 2014; Trabelsi and Trad, 2017; Sun et al., 2017). Return on asset (ROA) is net profit after tax and zakat to total assets. Return on equity (ROE) is defined as net profit divided by shareholder equity; NPM is the difference between financial income and financial costs.

3.1.2 Independent Variables

Independent variables are classified as internal (bank-specific) and external variables. Internal variables of bank profitability are associated with bank characteristics; external factors are macroeconomic variables, and dummy variables were created to represent the GFC. To examine whether investing in Islamic loans impacts profitability, LOAN/TA is used as a measure of liquidity and risk. Islamic loans in IBs include Murabaha, Ijara, Salam and Istisna. A high LOAN/TA indicates that the bank has taken more financial stress by making excessive loans (Masood and Ashraf, 2012; Zarrouk et al. 2014; Khasawneh, 2016; Trabelsi and Trad, 2017). EQAS is a measure of capital adequacy. We expect positive relationship to be shown between total EQAS and IBs' profitability, according to prior studies (Bashir, 2003; Trabelsi and Trad, 2017; Hussien et al. 2019). The higher the EQAS ratio, the lower the need for external funding and therefore the higher the profitability of a bank. The bank's size is denoted by the logarithm of total assets (LOGTA). The profitability is affected by the bank size and usually considered positive or negative (Smirlock, 1985; Trabelsi and Trad, 2017). Some studies find that small IBs are financially stronger than large IBs (Čihák and Hesse, 2010), while other studies find the opposite, arguing that larger banks are more able to generate profits as they take advantage of the economics of scale (Masood and Ashraf, 2012) and are more able to diversify and expand their investments and services (Alzoubi, 2018).

Leverage is represented by DEPEQ (debt to equity); if the capital of a bank is lower than its debt, the possibility of financial losses will be higher. The bank capital plays a major role in absorbing potential financial

risks. Therefore, lower ratio of debt to equity is favourable for banks (Masood and Ashraf, 2012). Managers' decisions on the capital structure (debt to equity) will affect the profitability and market value of IB²

Table 2: Definition of study variables

Variable	Measure		Expected Effect
Profitability	Return on Assets (RAO) = Net income/Total Assets Return on Equity (ROE) = Net income/Equity NET Profit Margin	ROA ROE NPM	
Size	Natural Logarithm of Total Assets	LOGTA	+/-
Capital Adequacy	Equity/ Total Assets	EQAS	+ /-
Asset Quality (credit risk)	Loans / Total Assets	LOANTA	-
Income diversification	Non-financial activities/total assets	NII/TA	+
Liquidity	Cash and cash equivalent to total assets	CATA	
Asset management	Operating income/ Total Assets	OPITA	+
Deposit	Deposits/Total Assets	DEPTA	+
Leverage	Total Debt/ Total Equity	DEPEQ	-
Operational Efficiency	The cost of overhead/ Total asset Total Operating Expenses/Total Assets	OPE	+
Economic Activity	Natural Logarithm of Annual Real GDP Growth Rate	LOGGDP	+
Inflation	Annual Inflation Rate (Consumer Price Index, CPI)	INF	-
Time	Global Financial crisis	GFC	+ -

Source: DataStream and the World Bank outlook

To investigate whether non-financial activities impact profitability of IBs, NII/TA is used to represent this variable. Cash and cash equivalents CA/TA are used to capture the impact of liquidity. The higher percentage of ratio indicates that banks have more liquidity. The main reason for bank failure is inadequate liquidity (Masood and Ashraf, 2012). On the other hand, having too much liquidity may lead banks to lose higher return of investment (an opportunity cost). As IBs are banned from access to inter-banking market or hedging instruments, it is argued that they are potentially less exposed to liquidity risk compared to large CBs (Čihák and Hesse, 2010; Kassim and Abdullah, 2012).

To measure how operating income affects profitability of banks, we employed operating income to total assets (OPITA), and in order to assess whether IBs have a good management of their expenditures, we used the most common variable, the operational efficiency (OPE) (Masood and Ashraf, 2012). Deposit to total assets (DEPTA) is considered the key and lowest cost and the main source of banks' funding, and we expect that the higher this ratio, the higher profitability for IBs.

However, other variables we believe would affect the performance of IBs are macroeconomic variables and the GFC (2007-2009). Annual real gross domestic product growth rate (GDP) represents the total economic activity. The prior studies find a positive relationship between GDP growth and profitability of banks (Masood and Ashraf, 2012; Zarrouk et al. 2014; Khasawneh, 2016; Trabelsi and Trad, 2017). INF is used to examine the effect of inflation on profitability. Finally, GFC captures the impact of GFC on IBs' performance.

3.2 The Arellano and Bond (1991) GMM Model

The least squares estimation is inappropriate since it generates biased and inconsistent estimates (Baltagi, 20012005). Therefore, in order to eliminate unobserved heterogeneity for IBs, this paper employs the Arellano and Bond (1991) generalized method of moments (GMM), using lagged dependent variables to deal with endogeneity issue as well as taking one lagged value of two endogenous variables, namely capital adequacy (EQAS). This model should not be employed if the study period is short, but in our study, this issue does not exist as it covers the period for 2004- 2017. This model has been applied in the IBs' literature (e.g. Zarrouk et al., 2016; Trabelsi and Trad, 2017; Sun et al., 2017). We

employed two diagnostic tests. Firstly, we tested whether there is existence of first and second order serial correlation; the test should reject the second order to ensure that there is no serial correlation among residuals. Secondly, we checked the validity of over-identification restrictions using the Sargan test (Baltagi, 2005; Athanasoglou et al, 2008).

To empirically investigate how profitability of IBs is determined, this paper follows Athanasoglou et al. (2008) and Zarrouk et al. (2014), employing a dynamic linear model given by equation (1)

$$P_{it} = C + \delta P_{it-1} + \sum_{i=1}^n \lambda_i Z_i + \sum_{i=1}^n \lambda_i Y_i + \sum_{i=1}^n \lambda_i D_i + \varepsilon_{it} \quad (1)$$

where P_{it-1} is the lagged value of profitability variables, $[[P]]_{it-1}$. However, Z_i in the model denotes bank-specific variables, while Y_i represents macroeconomic and D_i refers to dummy variable GFC.

4. Empirical Findings

Table 3 reports descriptive statistics for the study's variables. It shows the mean and standard deviation value for variables. The average value is represented by the mean, while standard deviation shows deviation of values from the mean. The descriptive statistics show that the average of return on assets (ROA) in our banks sample is 1.73 percent, whereas the return on equity (ROE) mean is 11.23 over the study period. Regarding the ratio of capital adequacy (EQAS), mean is 21.32 percent and standard deviation is 18.60 percent, whilst the mean for income generated from non-financial activities (NIITA) is 0.0123 percent and standard deviation is 0.016. The average for the ratio of loans to average total assets (LOANTA) is about 60 percent and for deposits to average total assets is 76 percent. The average for asset management to measure operating income over average total assets (OPETA) is 0.013 percent and exposes standard deviation 0.019.

Table 3: Descriptive statistics

Variable	Mean	Std. Dev	Min	Max
ROA	1.73	2.27	-6.76	13.21
ROE	11.23	20.11	-261.52	184.22
NPM	17.23	46.95	-558.39	174.68
EQAS	21.32	18.60	-2.84	204.41
LOGTA	16.79	2.21	11.17191	22.93
DEPEQ	.7559	.651	0	3.86
NIITA	.0123	.0158	-.1058638	0.1361
CATA	.0989	.102	.0037726	0.7068
LOANTA	.5925	.253	0	1.1867
OPETA	.0137	.019	-.111677	.1318
DEPTA	2.134	11.20	0	145.195
INF	4.915	4.86	-4.863278	53.24
LOGGDP	1.545	.651	-.6913948	3.991
OPE	.0451	.030	0	0.253

To examine whether there is multi-collinearity among independent variables, table 4 shows the relationship between independent variables we used to examine how they affect probability. As Table 4 demonstrates, the correlation among the independent variables is extremely low, clarifying that there is no existence of multi-collinearity.

Table 4: Correlation matrix

	inf	eqas	ope	opeta	depta	loggdp	logta	depeq	niita	cata	loanta
inf	1										
eqas	-0.12	1									
ope	0.29	-0.1	1								
opeta	0.15	-0.04	-0.15	1							
depta	0.02	0.02	-0.09	0.03	1						
loggdp	0.09	0.12	-0.01	0.19	0.08	1					
logta	0.21	-0.21	0.18	0.2	0.08	0.07	1				
depeq	-0.02	-0.22	0.12	0.26	-0.09	-0.18	-0.01	1			
niita	0.1	-0.04	0	0.49	0.36	0.09	-0.06	-0.1	1		
cata	0.06	0.17	0.03	-0.01	0.24	0.05	0.13	-0.23	-0.24	1	
loanta	-0.08	-0.02	-0.13	0.09	-0.47	0.09	-0.35	0.02	0.16	-0.44	1

In table 5, we report the results of Arellano Bond regressions for all IBs. Estimations of GMM revealed stable coefficient as the Sargan test, showing no evidence of over-identifying restrictions for all regressions. Although the tests suggest that negative first-order autocorrelation is evident, this does not mean that estimates are inconsistent (Arellano and Bond, 1991). In addition, the dynamic character of the model specification is confirmed as a highly significant coefficient of lagged ROA, ROE and NPM at 5% and 1% significance level. Empirical findings suggest that maintaining high capital ratio would lead IBs to be more profitable, confirming the argument of Berger (1995) that well-capitalised banks are likely to be safer and perform much better than banks with low capital. Furthermore, capital ratios are a reliable source in predicting potential bankruptcies (Chazi and Syed, 2010). In addition, Laeven and Levine (2009) advocate that a bank with higher equity is able to employ risk-taking policies and therefore higher profits, while maintaining high level of capital adequacy would help banks to expand their activities and withstand with any potential financial distress (Elfeituri, 2018). Further, unlike the debt capital, having more equity in IBs (based on profit-loss sharing principle) that is not subject to withdrawal would allow them to invest in long-term profitable assets, boosting profitability (Alzoubi, 2018).

Table 5: regression results using AB (1991)-GMM model

	ROA	ROA	ROE	ROE	NPM	NPM
L.ROA	-0.00327 (-0.11)	0.0369** -2.18	-0.339*** (-42.37)	-0.371*** (-18.83)	0.0770*** -3.29	0.0349** -2.39
EQAS	0.00739 -0.49	0.00939 -0.8	1.464*** -3.43	1.337*** -5.36	-0.433*** (-3.29)	-0.935*** (-6.08)
LOGTA	0.016 -0.07	0.0546 -0.45	8.865** -2.13	10.52*** -3.87	5.168** -2.45	3.783* -1.89
DEPEQ	-0.138 (-0.77)	-0.179** (-2.30)	-10.30*** (-3.09)	-10.01*** (-4.22)	-3.668*** (-2.58)	-1.998* (-1.73)
NII/TA	24.00*** -2.74	8.717* -1.72	-532.0*** (-3.21)	-508.3*** (-2.85)	-506.5*** (-4.84)	-572.2*** (-3.50)
CATA	-0.83 (-0.78)	-1.672 (-1.15)	-22.11 (-1.00)	-26.18* (-1.78)	-41.31** (-2.47)	-53.54*** (-3.19)

	ROA	ROA	ROE	ROE	NPM	NPM
LOANT	-1.243**	-1.351*	12.8	3.294	-10.02	-16.17**
A	(-2.51)	(-1.94)	-0.94	-0.38	(-0.97)	(-2.16)
OPITA	91.77***	98.37***	907.5***	1056.7***	1066.6***	1528.3***
	-14.29	-22.21	-7.44	-9.28	-7.55	-11.31
OPE	-0.764	8.487*	-391.5***	-284.5***	-288.7***	-209.9**
	(-0.10)	-1.8	(-3.79)	(-4.06)	(-3.81)	(-2.31)
DEPTA	-0.104	0.231	2.573*	1.624	0.282	-0.846
	(-0.67)	-0.86	-1.9	-1.43	-0.44	(-0.84)
INF	-0.0000553		0.298		-0.00718	
	(-0.01)		-1.25		(-0.05)	
LOGGD	0.178***		1.549		1.337*	
P	-4.63		-0.99		-1.68	
GFC	0.527***	0.251***	14.15***	14.83***	4.351*	2.765*
	-4.41	-2.86	-4.73	-13.39	-1.92	-1.78
Constant	0.504	-0.548	-137.5*	-163.1***	-50.87	-21.43
	-0.11	(-0.21)	(-1.88)	(-3.12)	(-1.16)	(-0.54)
AB	-2.4222	-2.1985	-1.2779	-1.278	-2.1269	-1.9764
	0.0154	0.0279	0.2013	0.2013	0.0334	0.0481
	-1.0347	-1.6505	-5.3687	-1.2252	1.2381	1.3778
	0.3008	0.1088	0.5914	0.2205	0.2157	0.1683
Sargan	21.49	18.44	21.1	25.79	23.53	25.24
test	0.9999	0.9988	0.9991	0.9999	0.9988	0.9993
Wald	176651.6	708820.64	114278.93	19442.57	37623.75	128040.53
chi2	0	0	0	0	0	0
t statistics in parentheses						
="* p<0.10						
** p<0.05						
*** p<0.01"						

Dependent variables: ROA: return on assets, ROE: return on equity, NPM: net profit margin.

Independent variables: LROA, LROE, LNPM 1 lag of dependent variables, EQAS: equity to assets, LOGTA=:log of bank total assets, DEPEQ: debt to equity, NII/TA: non-interest income to total assets, CATA: cash and cash equivalents to total assets, LOANTA: total loans to total assets, OPITA=operating income to total assets, OPE: operational efficiency, DEPTA: deposits to assets, INF: inflation, LOGGDP: log of gross domestic product, GFC: dummy variable of global financial crisis.

It is interesting to find that non-traditional activities (NII/TA) from services and other investments are found to have a positive impact on profitability measured by ROA and ROE, and NPM in line with what Zarrouk et al. (2014) found. This result implies that IBs need to go much further for earnings diversification strategy to maintain their market share in the market with CBs. Our paper also finds that profitability of IBs is positively influenced by Asset Management (OPITA) at 1% significant level. This finding confirms that managing assets efficiently would lead to generating economic benefits to a bank via optimal allocation of resources, which is essential for bank survival. Meanwhile, loan to total assets ratio (LOANTA) is negatively related to profitability, in contrast to Bashir (2003) and Masood and Ashraf (2012). However, the former reports that the nonperforming loans variable is negatively related to profitability. Our finding can be justified by the higher fees charged by IBs compared to CBs' fees and monitoring cost increases for higher amounts of loans in terms of originated, serviced and monitored. This is consistent with Soheli et al. (2019) who found that IBs have a greater reliance on fees than returns from loans to increase their profitability, although, over-reliance on fee-based income may affect their growth, profitability and sustainability in the long run. Soheli et al. (2019) argue that this may be due to the IBs' size, their business experience and religious requirements. Therefore, IBs need to reconsider fees charged to customers to cover costs associated with loans and to maintain a market share with CBs. Examining the impact of liquidity measured by cash and cash equivalent to total assets (CATA), this variable is found to have a negative relationship to profitability for all models and to be highly significant with ROE and NPM. Such output confirms that maintaining high levels of liquid assets is not beneficial for banks, in line with the view that additional liquidity should be invested in new investment opportunities to ensure better growth and increasing profitability.

The gearing (debt to equity) ratio shows a negative relationship to the bank's profitability and is highly significant in all models, with the

exception of model 1. This result confirms that the high level of capital would help banks to absorb financial losses, and that sound protection can be gained by keeping a suitable level of capital against any decrease of bank's assets value or NPL. Therefore, it is crucial to maintain a lower ratio of debt to equity for banks to avoid financing costs and high levels of debt (Masood and Ashraf, 2012). As expected, poor cost management represented by total overheads to total assets (OPE) leads to reduced profitability for banks as the relatively high coefficient of OPE is negative and significant for all regressions. The higher the ratio of OPE, the lower the operational efficiency and, consequently, the lower the profit. Such findings are supported by Demircug-Kunt and Huizinga (1999), Pasiouras and Kosmidou (2007); Dietrich and Wanzenried (2014). We argue that the administrative and personnel expenses are relatively high in such cases due to bad management and political purpose. This suggests that IBs should take the necessary actions to operate efficiently and thereby increase profits. However, in respect to the impact of the GFC on profitability, IBs during the GFC have increased their profitability. This result indicates that those IBs are not especially exposed to international banks as they mainly focus on Islamic product. While IBs' business model precludes them from granting subprime loans, leverage, taking excessive risks (Gharar) and risky financial instruments, they are less susceptible to the crisis (see Čihák and Hesse, 2010; Hasan and Dridi, 2011; Beck et al., 2013; Alqahtani and Mayes, 2017). Moreover, IBs were able to maintain better capital ratios during the GFC, which shielded them from the severe effects of the crisis (see Chazi and Syed, 2010). Finally, regarding the macroeconomic variables, LOGGDP has significant and positive effect on profitability, supporting the argument for the positive association between economic growth and banking sector performance, in line with Bashir (2003), Zeitun (2012), Khasawneh, (2016), Zarrouk et al. (2016) and Hussien et al. (2019).

5. Conclusion

This paper has investigated the determinants of IBs' profitability using a large sample of banks from 12 counties for the period 2004-2017, using the GMM model. This study is considered greatly beneficial since it focuses on countries that have not been examined as intensely as well-developed countries. Our findings answered the research question of the study that profitability of IBs is shaped by bank-specific and macroeconomic variables. We confirm that the non-traditional activities

(NII/TA) from services and other investments are found to have a positive impact on profitability, suggesting that IBs need go much further for earnings diversification to increase their market share in the banking sector alongside CBs. This significant result clarified that IBs have successfully gained a competitive edge over CBs via focusing on sources of income other than the traditional lending activities.

Moreover, results confirm that the high level of capital would help banks to absorb financial losses and that sound protection can be gained by keeping suitable levels of capital against any decrease of banks' assets value or non-performing loans. Thus, maintaining lower ratio of debt to equity is crucial for banks to protect themselves from financing costs. Regarding the impact of the GFC on profitability, IBs during the GFC have increased their profitability over this period, indicating that those IBs are not exposed to international banks. In this matter, we argued that IBs rely heavily on Islamic product and avoid granting subprime loans and investing in risky financial instruments. Moreover, IBs were able to maintain better capital ratios during GFC, which safeguarded them from the severe effects of the crisis. This outcome confirms that central banks in these countries should verify that all banks are well-capitalised to ensure that they are protected against any potential financial distress, and therefore that the stability of the banking sector is secured.

However, the asset quality represented by loan to total assets ratio (LOANTA) is negatively related to profitability. This finding can be justified by the higher fees charged by IBs compared to CBs' fees and monitoring cost increases for higher amounts of loans in terms of origin, servicing, and monitoring have led to decreased profitability of IBs. The IBs have greater reliance on fees than returns from loans to increase their profitability. Therefore, they need to consider that the over-reliance on fee-based income may affect their growth, profitability, and sustainability in the long run.

Finally, this paper showed that economic growth has positively affected profitability of IBs, suggesting that policymakers and regulators need to set policies in favour of stimulating the economy to ensure growth and survival of IBs and the banking sector as whole.

5.1 Limitations and Future Studies

This study has focused on fully-fledged IBs and not on Islamic “windows” or Islamic branches operated by some commercial banks. Furthermore, data limitations prevented us from including all IBs as we had to exclude some countries from the studied sample due to lack of financial data. This study can be extended in terms of the study period and sample size by including additional variables to examine how competition and market structure affect IBs performance compared to CBs in developing countries.

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Comparing the long term growth-enhancing effect of RCEP and CPTPP: Evidence from Malaysia

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ABSTRACT

By using a simple export-led growth model, this study compares the growth-enhancing effect of RCEP and CPTPP for the Malaysian economy. Based on data from November 2012 to August 2019, the results indicate that, first, total exports to member countries of RCEP is found to have a long-run relationship with Malaysia's Industrial Production Index (IPI). There is no cointegration relationship between IPI and total exports to member countries of CPTPP. Second, the growth-enhancing effect of RCEP is found to be greater than CPTPP. Third, the results obtained for RCEP are robust even with the exclusion of Malaysia's major trading partners in the RCEP agreement. Based on the findings, this study offers some policy recommendations.

ملخص

تقارن هذه الدراسة، باستخدام نموذج بسيط للنمو القائم على التصدير، الأثر المعزز للنمو الذي تحدثه الشراكة الاقتصادية الإقليمية الشاملة (RCEP) واتفاق الشراكة الشاملة والتقدمية عبر المحيط الهادئ (CPTPP) بالنسبة للاقتصاد الماليزي. واستنادا إلى البيانات المستمدة عن الفترة ما بين نوفمبر 2012 و أغسطس 2019، تشير النتائج إلى: أولاً، لدى إجمالي الصادرات إلى البلدان الأعضاء في الشراكة الاقتصادية الإقليمية الشاملة علاقة طويلة الأمد بمؤشر الإنتاج الصناعي في ماليزيا. ولا توجد علاقة اندماج مشترك بين مؤشر الإنتاج الصناعي ومجموع الصادرات إلى البلدان الأعضاء في اتفاق الشراكة الشاملة والتقدمية عبر المحيط الهادئ. وثانياً، يتبين أن الأثر المعزز للنمو الذي تخلفه الشراكة الاقتصادية الإقليمية الشاملة أكبر من اتفاق الشراكة الشاملة والتقدمية عبر المحيط الهادئ. وثالثاً، إن النتائج التي تم التوصل إليها بالنسبة للشراكة الاقتصادية الإقليمية الشاملة قوية حتى مع استبعاد الشركاء التجاريين الرئيسيين لماليزيا في اتفاق هذه الشراكة. واستنادا إلى النتائج، تقدم هذه الدراسة بعض التوصيات المتعلقة بالسياسة العامة.

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ABSTRAITE

En utilisant un modèle simple de croissance tirée par les exportations, cette étude compare l'effet de renforcement de la croissance du RCEP et du CPTPP pour l'économie malaisienne. Sur la base de données allant de novembre 2012 à août 2019, les résultats indiquent que, premièrement, les exportations totales vers les pays membres du RCEP ont une relation à long terme avec l'indice de production industrielle (IPI) de la Malaisie. Il n'y a pas de relation de cointégration entre l'IPI et les exportations totales vers les pays membres du CPTPP. Deuxièmement, l'effet de renforcement de la croissance du RCEP est plus important que celui du CPTPP. Troisièmement, les résultats obtenus pour le RCEP sont robustes même avec l'exclusion des principaux partenaires commerciaux de la Malaisie dans l'accord RCEP. Sur la base de ces résultats, cette étude propose quelques recommandations politiques.

Keywords: Comprehensive Economic Partnership (RCEP), Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), export-led growth model, growth-enhancing effect, cointegration relationship, Malaysia

1. JEL Classification: F02, F13, F14, F15, F41 Introduction

The Malaysian government was initially keen on signing both the TPP and the RCEP. It is argued that Malaysia would be able to experience more trade and investment by signing both trade agreements. It was also thought that engagement with both FTAs would allow the country to be the trade and investment hub for ASEAN. This was an attractive proposition given the size of the ASEAN market which has a population of 622 million and member countries with high growth rates.

The theoretical argument between trade and economic growth can be traced back to the theory of comparative advantage by Ricardo (1817), whereby both trading countries would result in welfare gain if they specialize on their comparative advantage goods. Subsequently, the factor endowment trade theory (Heckscher, 1919; Ohlin, 1933; Stolper and Samuelson, 1941) argued that difference in factor endowment is the main cause of trade, whereby countries would gain from trade if they specializes on the production of goods and services which its abundant factor is intensively used. Apart from the conventional trade theory, the new trade theory argues that trade fosters economic growth through the creation of innovation and knowledge spillovers in different countries. In particular, international trade provides greater access to a large international market, advanced technology, and a larger stock of

knowledge. This in turn facilitates knowledge transfer between countries, leading to more innovation and fosters economic growth (Grossman and Helpman, 1989, 1990, 1991 and Krugman, 1990). Thus, the new trade theory postulated that country with higher degree of trade openness would have greater technological spillovers, and therefore experience faster growth than country with lower degree of trade openness. Taken together, all the above theoretical justifications posit that international trade is beneficial for country's economic growth.

The TPP was viewed as useful to Malaysia because Malaysia's trade with USA was declining in importance. The TPP was seen as a way of gaining access to the US market. Historically, Malaysia had initiated the US-Malaysia FTA in 2005 but it was never completed. The TPP was, therefore, a chance for Malaysia to conclude an agreement with US, although it was not a bilateral agreement. However, US withdrew from the TPP, resulting in the re-designation of the agreement as the CPTPP. With the new CPTPP, Malaysia is still undecided as to whether it would be beneficial to be a part of the arrangement. Hence, Malaysia has not ratified the agreement yet. There are two issues on which Malaysia has concerns regarding the CPTPP. First, the government is undecided as to whether the gains from the FTA are worthwhile given the high quality of the agreement. Second, government procurement, intellectual property rights and ISDS are aspects of the agreement that the present government finds unfavourable. Thus, there is some reluctance to ratify the CPTPP.

The other mega FTA that Malaysia has an interest in is RCEP, with its membership of ASEAN countries and its trading partners. The advantage of RCEP is that it retains ASEAN centrality while also engaging three globally powerful economies, that is, China, India and Japan. Notably, RCEP has been officially signed in November 2020 but with the exclusion of India from the agreement. The RCEP marks ASEAN's biggest free trade pact to date, covering a market of 2.2 billion people with a combined size of US\$26.2 trillion or 30% of the world's GDP (ASEAN Secretariat News, 2020). Given the important role played by the two trade agreements, it is interesting to examine which agreement is beneficial to the Malaysia's economic performance.

Empirical research has examined the economic impact of CPTPP and RCEP. For CPTPP, Dasgupta and Mukhopadhyay (2017) found that with the US in the TPP, all the ASEAN countries in the TPP will enjoy welfare

gains and positive growth in output and trade. Again, the results show that Vietnam and Malaysia will gain the most. However, a TPP without US, which is known as CPTPP, still promises positive growth rates but there is a considerable reduction in welfare, output and export growth for the ASEAN members as compared to a TPP with the US. Furthermore, Vietnam and Malaysia according to their results are most affected by the withdrawal of US. Similarly, the grow-enhancing effect of CPTPP is consistent with the latter study by Khan et al (2018); Li and Whalley (2020); Li et al (2020). However, study by Banga (2019) models the implications of Malaysia joining the CPTPP using SMART simulations. Results indicate that exports will not rise much because Malaysia already has free trade agreements with Japan, Singapore and Australia. Malaysia's exports to these countries account for 84 per cent of exports to CPTPP members.

For RCEP, simulations generated by Guo and Li (2019) lead them to conclude that China will enjoy welfare gains from all the FTAs that are considered, and that includes the China-Japan-Korea, China-Asean, China-Gulf Cooperation Council FTAs and the FTAAP and RCEP. Results indicate that RCEP is expected to yield the highest welfare gain for China. In a related study, Li and Moon (2018) examine the effects of RCEP on trade and income in China and Korea. According to their model with RCEP, both Korea and China's total trade will increase, and so will income.

Next, in comparing the welfare and sectoral effect between CPTPP and RCEP, Lee and Itakura (2018) found that ASEAN countries are likely to enjoy greater welfare gains from RCEP than CPTPP. In any case, the study found that the textiles and apparel and electronic sectors stand to benefit from these scenarios. However, recent study by Itakura and Lee (2019) found that both CPTPP and RCEP are equally important for ASEAN countries and the rest of the world, whereby there is no substantial different in the welfare and output gain from the two trade agreements. In contrast, study by Petri and Plummer (2020) found that RCEP has a greater output-enhancing effect as compared to CPTPP. In the presence of US-China trade war, RCEP and CPTPP would raise global income by USD 209 billion and USD 121 billion annually by 2030, respectively. Moreover, the study estimated that China, Japan and South Korea would yield the largest benefits from the two trade agreements.

The mix findings mentioned above motivate this study to re-examine the economic impact of CPTPP and RCEP. In particular, this study compares the growth-enhancing effect of CPTPP and RCEP on the Malaysian economy. Malaysia is an interesting case for analysis for three reasons. First, Malaysia is one of the few countries in ASEAN that is contemplating both the CPTPP and RCEP. While Malaysia is a member of ASEAN and therefore values RCEP, Malaysia also wants to gain from the CPTPP. Second, the previous government under Najib Razak was certain that Malaysia would gain by participating in both agreements. The present government is undecided. Hence it has not ratified the CPTPP. Third, Malaysia perceived CPTPP and RCEP as being complementary. Thus, there would be additional benefits from being in the CPTPP, that is, further to RCEP. Given these reasons, it is useful to determine the bottom-line for Malaysia. The analysis we are undertaking will explain what is the least that Malaysia can do. Also, it will give an idea if the gains from the CPTPP are too considerable to be foregone.

As we can see, Malaysia has two FTAs that it can consider: CPTPP and RCEP. The question with regard to CPTPP is whether or not it will be beneficial to Malaysia, since US is out of the deal. As for RCEP, for the moment India is out of the FTA. Thus, it is necessary to assess which of the following FTAs are most favourable to Malaysia: CPTPP or RCEP without India. This will help us to determine whether the most important trade variable for Malaysia is USA, India or ASEAN.

This study differs from the previous literature in three ways. First, unlike previous literature which examines the aggregate economic impact of free trade agreements, this study examines in detail how the export to member countries of a free trade agreement would benefit the Malaysia economy. This study uses a simple export-led growth model to quantify the economic effect of CPTPP and RCEP on the Malaysian economy. This is justifiable on the basis that one of the objectives of free trade agreements is to lower tariff and facilitate trade among member countries. Ultimately, greater export would translate into higher economic growth for member countries. Hence, the use of export-led growth model is appropriate in explaining the economic gains obtained from free trade agreement, particularly from the export of goods and services to member countries.

Second, the long-run relationship between Malaysia's economic growth and export to member countries of CPTPP and RCEP is not well

established in the existing literature. In this regard, this study examines the existence of a cointegration relationship between export to member countries of CPTPP and RCEP with Malaysia's economic growth. This is important as it would identify which free trade agreement is the source of long term growth for Malaysia. Third, this paper differs from the existing studies by providing various scenarios on the withdrawal of member countries from both trade agreements. This would provide insight on which agreement is beneficial to Malaysia despite the withdrawal of member countries.

Based on the Non-linear Autoregressive Distributed Lag (NARDL) model proposed by Shin et al (2014), the empirical results demonstrate that: First, there exists a long-run relationship between Malaysia's Industrial Production Index (IPI) and the total export to member countries of RCEP, while there is no cointegration relationship between IPI and total export to member countries of CPTPP. Second, the growth-enhancing effect of RCEP is found to be greater than CPTPP. Third, the results obtained for RCEP are robust even with the exclusion of Malaysia's major trading partners, namely Singapore, China and Japan in the RCEP agreement.

In line with the empirical results, this study contributes to the debate on which FTAs are most favourable to Malaysia: CPTPP (i.e TPP without the US) or RCEP without India. Taken together, it can be argued that RCEP is imperative in facilitating the long-term economic growth in Malaysia, despite the withdrawal of India from the agreement. As such, there exists a long-run relationship between IPI and the total export to member countries of RCEP. This implies that export to member countries of RCEP would have a significant impact on the economic performance of Malaysia in the long-run. In particular, the result shows that an increase in the total exports to member countries of RCEP would lead to an expansion in the economic growth in the long-run, which is consistent with the export-led growth hypothesis. However, the reduction in total export to member countries of RCEP is found to have no impact on the Malaysia's economic performance and this is consistent with the export geographical diversification argument, in which the negative impact is offset by the increase in export to other trading partners.

This paper unfolds as follow. Section 2 provides the export-led growth model. Section 3 illustrates the data and methodology used in this study.

Section 4 presents estimation results. Section 5 provides the discussion for the results and policy recommendations. Section 6 sets forth conclusions.

2. Empirical Model

This study uses a simple export-led growth model for quantifying the growth-enhancing effect of CPTPP and RCEP on the Malaysian economy. The empirical model is as follows:

$$\ln IPI_t = \beta_0 + \beta_1 \ln Export_t + \varepsilon_t \quad (1)$$

Since monthly data on real GDP is not available, the Industrial production index (*IPI*) is used as a measure of real output. This is justifiable on the basis that the industrial production index is included as a coincident indicator for Malaysia's real activity (Ibrahim and Sufian 2014). Next, *Export* is a vector of total export of goods and services to member countries of RCEP and CPTPP. One of the objectives of free trade agreements (RCEP and CPTPP) is to facilitate the flow of goods and services among the member countries, therefore this study uses the total export to member countries of RCEP and CPTPP as a proxy to measure the economic impact of the two agreements. This is justifiable on the basis that exports are one of the major determinants of economic growth in Malaysia. Based on the data from World Bank, total export constitutes 68.76 percent of Malaysia GDP in 2018. Given this substantial amount of exports, it is interesting to examine whether the export to the member countries of CPTPP and RCEP would benefit the Malaysia economic growth. Next, *Ln* denotes the natural logarithm and ε_t is the error term.

Given that the objective of this study is to compare the impact of RCEP and CPTPP on Malaysia's economic growth, two assumptions are required to make on the empirical implementation of equation (1). As such:

Assumption 1: Both RCEP and CPTPP enter into force in November 2012.

Assumption 2: All member countries of RCEP and CPTPP agree to join the agreement in November 2012.

Given the latest development in both free trade agreements, India and United States will not be included into the member countries of RCEP and CPTPP, respectively. This study assumes that both agreements enter into force in November 2012. By doing so, a fair comparison on the impact of RCEP and CPTPP on Malaysia economic performance can be made. Moreover, this study selects the launch of RCEP negotiation (November 2012) as the starting period in order to have a sufficient sample size for the subsequent analysis. If the starting period is based on the time period where member countries agreed to conclude CPTPP (January 2018) or the time period where RCEP was officially signed (November 2020), the model will be estimated with lesser degree of freedoms (too many parameters in the model) and the analysis will be invalid. Despite using historical data in quantifying the economic impact of RCEP and CPTPP, the use of econometric method in this study would trace the impact of RCEP and CPTPP on Malaysia economic performance in the long-term period. This is important as it may provide direction to the Malaysia authority on which trade agreement is the source for long-term economic growth.

Next, assumption 2 is made in order to assess the full impact of the trade agreements on Malaysia's economic growth. However, this assumption will be relaxed in the subsequent analysis. This is because one may argue that RCEP would be beneficial to Malaysia's economic performance as compared to CPTPP due to the inclusion of major trading partners as the member countries of RCEP. To answer this, the top five trading partners of Malaysia which are also the member countries of RCEP will be removed from the model hypothetically. Subsequently, this would provide an answer whether the impact of RCEP on Malaysia economic performance is subjected to the inclusion of major trading partners.

3. Data and Methodology

3.1. Data

This study employs monthly data from November 2012 to August 2019. Table 1 shows the member countries of RCEP and CPTPP. Table 2 shows the list of variables used in this study. By following assumption 2 above, RCEP1 and CPTPP are used to access the impact of the two trade agreements on economic growth. Furthermore, RCEP2 to RCEP5 are used to capture the impact of RCEP on Malaysia economic performance

with the exclusion of major trading partners¹. For example, the construction of RCEP2 is arrived at by removing the total export to Singapore from the total export to member countries of RCEP.

Table 1: Member countries

Panel A: RCEP			
10 ASEAN countries		Six FTA partners	
Brunei	Myanmar		China
Cambodia	Philippines		Japan
Indonesia	Singapore	+	India
Laos	Thailand		South Korea
Malaysia	Vietnam		Australia
			New Zealand
Panel B: CPTPP			
Australia	Malaysia	Vietnam	Brunei
Mexico	Canada	New Zealand	Chile
Peru	Japan	Singapore	

Table 2: List of variable

Variable	Description
IPI	Industrial production index
RCEP1	Total export to member countries of RCEP excluding India
RCEP2	Total export to member countries of RCEP excluding India and Singapore
RCEP3	Total export to member countries of RCEP excluding India and China
RCEP4	Total export to member countries of RCEP excluding India and Japan
RCEP5	Total export to member countries of RCEP excluding India, Singapore, China and Japan
CPTPP	Total export to member countries of CPTPP excluding United States

Notes: Sample period: November 2012 to August 2019.

IPI is measured in index. The total export is measured in MYR million.

Total export refers to the total export of goods and services.

All the data are retrieved from Department of Statistics Malaysia.

3.2. Methodology

The Nonlinear Autoregressive Distributed Lag (NARDL) model developed by Shin et al (2014) is used to estimate equation (1) above. The NARDL model is used to examine the asymmetrical relationship between

¹ The list of Malaysia's top trading partner in 2018 can be found in <http://www.worldstopexports.com/malaysias-top-import-partners/>. However, Hong Kong and United States are not member countries of RCEP, and therefore they are not included in this study.

export and economic growth, in which economic growth may respond differently with respect to the increase and decrease in the total export.

The increase in export would improve the economic growth as indicated by the export-led growth hypothesis (McKinnon 1964; Balassa 1978; Sheehey 1990; Buffie 1992). As noted by Awokuse (2003), export expansion would serve as a catalyst for output growth both directly and indirectly. The former is due to the component of aggregate output, and therefore export growth will contribute directly to the growth in output level. The latter is due to foreign market competition, which leads to a greater capacity utilization, exploitation of economies of scale and improvement of technology level in the domestic economy. Subsequently, this improves domestic investment, thereby generating output growth.

Conversely, the decrease in export may have no impact on economic growth with the condition that country practices export geographical diversification. Generally, the practice of diversifying export portfolios into different sets of markets in the world allows developing countries to access a more stable revenue stream than of concentrating in just a few markets (Hinlo and Aranguez 2017). As noted by Shepherd (2009), demand shocks tend to be correlated across sectors and countries, therefore well-diversified economies would have a better scope in offsetting income losses caused by the drop in external demand from a group of trading partners. Accordingly, diversification of exports geographically would reduce export instability by reducing the dependence on a limited number of market destinations. Consequently, this would stabilize the domestic economic growth in the event of negative external demand shocks. Hence, it can be argued that there appears to be an asymmetrical relationship between export and economic growth. Therefore, the use of NARDL is appropriate in the context of this study to capture the asymmetry in response of economic growth toward the changes in total export.

Moreover, the used of NARDL allows this study to trace the long-run effect of the two trade agreements on Malaysian economic performance. This is imperative as it provides suggestions to the Malaysian authorities on which free trade agreement will be the engine of growth in the long-run. Therefore, the linear model in equation (1) can be re-written as follows:

$$LnIPI_t = \beta_0 + \beta_1 LnExport_t^+ + \beta_2 LnExport_t^- + \varepsilon_t \quad (2)$$

where $LnExport_t^+$ and $LnExport_t^-$ are partial sums of positive and negative changes in total export to member countries of RCEP and CPTPP:

$$LnExport_t^+ = \sum_{i=1}^t \Delta LnExport_t^+ = \sum_{i=1}^t \max(\Delta LnExport_i, 0) \quad (3)$$

and

$$LnExport_t^- = \sum_{i=1}^t \Delta LnExport_t^- = \sum_{i=1}^t \max(\Delta LnExport_i, 0) \quad (4)$$

The long-run relationship between economic growth and total export is β_1 and β_2 indicating respectively the increase and decrease in the exports. In the empirical implementation, the long-run equation (2) can be framed in an ARDL setting as in Shin et al (2014). That is:

$$\begin{aligned} \Delta LnIPI_t = & \theta_0 + \theta_1 LnIPI_{t-1} + \theta_2 LnExport_{t-1}^+ \\ & + \theta_3 LnExport_{t-1}^- + \sum_{i=1}^p \gamma_{1i} \Delta LnIPI_{t-i} \\ & + \sum_{i=0}^q \gamma_{2i}^+ \Delta LnExport_{t-i}^+ + \sum_{i=0}^q \gamma_{3i}^- \Delta LnExport_{t-i}^- + \varepsilon_t \end{aligned} \quad (5)$$

where all variables are as defined above and p and q are lag orders. Given monthly data, this study sets the maximum ARDL lag order to 12 as in Sukmana and Ibrahim (2017). In conducting the NARDL estimation, this study follows the steps as in Katrakidilis and Trachanas (2012), Fousekis et al, (2016) and Sukmana and Ibrahim (2017). First, equation (5) is estimated by using the OLS. To arrive at the final specification, this study applies the general-to-specific approach to sequentially remove the insignificant lags from the model. Second, the ARDL cointegration test will be conducted to check for the presence of long-run relationship between the two variables. This involves the Wald F test of the null hypothesis $\theta_1 = \theta_2 = \theta_3 = 0$ (Pesaran, Shin and Smith 2001) or the t-test of the null hypothesis that $\theta_1 = 0$ (Banerjee, Dolado and Mestre 1998). Third, after identifying the presence of long-run relationship, this study proceeds to test for both the long-run and short-run asymmetries. The null hypothesis for the long-run asymmetry is $-\theta_2/\theta_1 = -\theta_3/\theta_1$. While the null hypothesis for the short-run asymmetry is

$$\sum_{i=0}^q \gamma_{2i}^+ = \sum_{i=0}^q \gamma_{3i}^- \quad (6)$$

4. Empirical results

4.1. Descriptive statistics

Based on Table 3, on average, total export to member countries of RCEP (except RCEP5) is higher than total export to member countries of CPTPP. Similarly, the total export to member countries of RCEP (RCEP1 to RCEP4) appear to be highly volatile relative to CPTPP, as shown by higher standard deviation. All series are transformed into natural logarithm for the subsequent analysis.

Table 3: Descriptive statistics

Variables	Mean	Standard deviation	Maximum	Minimum
IPI	103.451	7.455	116.200	90.500
RCEP1	40585.480	5293.410	56342.420	31763.940
RCEP2	30697.570	3975.045	42969.860	23938.600
RCEP3	30334.500	3582.074	41225.610	25554.300
RCEP4	34485.980	5379.657	49729.500	24707.600
RCEP5	15347.110	2226.733	21240.120	11093.350
CPTPP	21865.148	2486.899	28898.962	17586.924

Notes: All the series above are based on original data values.

4.2. NARDL results

Unit root tests have been conducted. Notably, all the three tests (ADF, PP and KPSS) show consistent results in which none of the variables are integrated in order two $I(2)$, and therefore the ARDL bound test can be used to test for cointegration of the variables. The results are not reported here to conserve space but they are available upon request.

Table 4 shows the ARDL cointegration test. As observed, total export to member countries of RCEP is found to be cointegrated with IPI, even with the exclusion of Malaysia's major trading partners (Equation 1 to 5). However, no cointegration relationship can be found between IPI and total export to member countries of CPTPP (Equation 6). The results suggest that the total export to member countries of RCEP is imperative in affecting the Malaysia long-term economic performance. In other word, the cointegration test results inform that RCEP is the source of long-term economic growth for Malaysia as compared to CPTPP.

Table 4: ARDL cointegration test. Dependent variable: LnIPI

Equation	Export variable	Banerjee t-statistic	Pesaran Bound test	Critical value (5%)	
1	LnRCEP1	-4.945**	8.215**	Lower	Upper
2	LnRCEP2	-4.664**	7.543**	<i>Banerjee t-statistic</i>	
3	LnRCEP3	-4.962**	8.325**	-2.86	-3.22
4	LnRCEP4	-4.810**	7.811**	<i>Pesaran Bound test</i>	
5	LnRCEP5	-5.235**	9.465**	4.94	5.73
6	LnCPTPP	-2.526	2.181		

Notes: Critical values are from Pesaran et al (2001). ** denotes significant at 5% level.

Table 5 presents the NARDL results. The long-run coefficient, short-and long-run asymmetry tests are reported at the bottom of the table. By looking at RCEP, it can be observed that the Wald F test statistics for the null hypothesis of long-run asymmetry is significant at 1 percent level in all cases. The null hypothesis of short-run asymmetry is rejected only in RCEP1, RCEP3 and RCEP4. Given the focus of this study is to examine which agreement is the source of long-term economic growth for Malaysia, the subsequent explanation will focus on the long-run effect of RCEP and CPTPP.

Focusing on the total export to member countries of RCEP with the exclusion of India (RCEP1), the long-run coefficients of the total export increase and the total export decrease to be respectively 0.082 and 0.002. The former is significant at 1 percent level while the latter is found to be insignificant. This means that the increase in total export to member countries of RCEP1 by 1 percent is related to an expansion in Malaysia IPI by 0.082 percent. This finding is consistent with the export-led growth hypothesis as mentioned above, in which export expansion would contribute to higher economic growth. Meanwhile, the decrease in total export to member countries of RCEP1 is found to have no impact on Malaysia's economic performance. The result is consistent with the above-mentioned argument, in which the practice of export geographical diversification would offset the income losses caused by the drop in external demand from a group of trading partners. The results documented for RCEP2 to RCEP 5 remain similar.

A similar conclusion can be obtained for CPTPP, in which there exists long-run asymmetry relationship between IPI and total export to member

countries of CPTPP. As such, the increase in total export is found to have an expansionary effect on IPI, while the decrease in total export is found to have an insignificant influence on IPI.

The above findings are particularly true in the context of Malaysia. As such, being an export-oriented economy, the export sector plays an important role in affecting the country's economic performance. Therefore, by engaging in free trade agreements, the export sector can be expanded in the context of increasing export destinations. Subsequently, this would boost the country's total exports, thereby contributing to economic growth. Besides entering into the RCEP or CPTPP, Malaysia also has trade agreements with other countries in the world¹. Therefore, the reduction in the export to member countries of RCEP or CPTPP would have no impact on domestic economic performance as the negative effect may be offset by the increase in export to other trading partners.

We now turn to the main focus of this study, that is, to compare the effect of RCEP and CPTPP on Malaysia's economic growth. We focus on RCEP1 and CPTPP (Equation 1 and 6 in Table 5), where India and United States have been removed from the two agreement respectively. The long-run coefficients show that the growth-enhancing effect of total export to member countries of RCEP1 is higher than the total export to member countries of CPTPP (0.082 versus 0.074). Moreover, the former has a stronger influence on Malaysia's IPI as the relationship is significant at 1 percent level. While the latter is only significant at 10 percent level. This indicates that RCEP is the source of long-term economic growth for Malaysia, despite the withdrawal of India from the agreement.

To ensure the robustness of the relationship between IPI and total export to member countries of RCEP, this study removes assumption 2 above by assuming that Malaysia's major trading partners withdraw from the RCEP agreement. Notably, the role of RCEP in affecting Malaysia's long-term economic growth remains robust even with the removal of Malaysia's major trading partners (Equation 2 to Equation 5 in Table 5). As such, total export to member countries of RCEP with the exclusion of Singapore (Equation 2), China (Equation 3) and Japan (Equation 4) is found to have a long-run and positive relationship with Malaysia IPI. Next, Equation 5

¹ The detail information on how many trade agreements has Malaysia involved in is available in <https://www.export.gov/article?id=Malaysia-Trade-Agreements>

provides an extreme scenario whereby Singapore, China and Japan are excluded from the RCEP. Despite this, RCEP remains favourable to the Malaysia economic growth. All the equations pass the diagnostic checks of no serial autocorrelation and normality test.

Taken together, it can be argued that RCEP is imperative in facilitating the long-term economic growth in Malaysia, despite the withdrawal of India from the agreement. As such, there exists a long-run relationship between IPI and the total export to member countries of RCEP as opposed to the relationship between IPI and total export to member countries of CPTPP, in which no long-run relationship can be found. This implies that export to member countries of RCEP would have a significant impact on the economic performance of Malaysia in the long-run.

In particular, the results shows that an increase in the total export to member countries of RCEP would lead to an expansion in the economic growth in the long-run, which is consistent with the export-led growth hypothesis. While, the reduction in total export to member countries of RCEP is found to have no impact on the Malaysia economic performance and this is consistent with export geographical diversification argument, in which the negative impact is offset by the increase in export to other trading partners. In addition, the growth-enhancing effect of total export to member countries of RCEP is higher than the total export to member countries of CPTPP. Furthermore, the positive impact of RCEP on Malaysia's economic performance is robust even with the absence of Malaysia's major trading partners in the RCEP agreement. Thus, RCEP is the source of long-term economic growth for Malaysia's economy. Notably, the results obtained concur with earlier studies by Lee and Itakura (2018) and Li and Moon (2018), whereby RCEP is found to benefit ASEAN countries as compared to CPTPP.

Table 5: NARDL estimation results. Dependent variable: LnPI

Trade agreement Equations Variable	RCEP					CPTPP	
	(1) RCEP1	(2) RCEP2	(3) RCEP3	(4) RCEP4	(5) RCEP5	(6) CPTPP	(6) CPTPP
Constant	2.258***	2.209***	2.312***	2.166***	2.537***	1.519**	1.519**
LnPI_{t-1}	-0.497***	-0.487***	-0.509***	-0.477***	-0.559***	-0.334**	-0.334**
LnExport_{t-1}^+	0.041**	0.025*	0.051***	0.035**	0.027**	0.025	0.025
LnExport_{t-1}^-	0.001	-0.013	0.012	0.001	-0.009	0.001	0.001
ΔLnPI_{t-1}						-0.334**	-0.334**
ΔLnPI_{t-2}				0.192**	0.221**	-0.237*	-0.237*
ΔLnPI_{t-9}						-0.188**	-0.188**
$\Delta \text{LnPI}_{t-12}$							
$\Delta \text{LnExport}_{t-1}^-$	0.068***		0.077***	0.054**			
$\Delta \text{LnExport}_{t-2}^-$							
$\Delta \text{LnExport}_{t-6}$							
Long-run asymmetry							
LnExport_t^+	0.082***	0.051*	0.099***	0.075***	0.048**	0.074*	0.074*
LnExport_t^-	0.002	0.027	0.025	0.001	0.017	0.002	0.002
W_{LR}	257.9***	281.1***	301.4***	182.8***	325.8***	131.6***	131.6***
Short-run asymmetry							
W_{SR}	7.90***		9.678***	5.591**			
Diagnostic checks							
Portmanteau test	0.177	0.031**	0.202	0.427	0.204	0.105	0.105
Jarque-Bera test	0.585	0.264	0.562	0.917	0.523	0.241	0.241

Notes: *, ** and *** denotes significance at 10%, 5% and 1% respectively. WLR and WSR stand for Wald test for long-run asymmetry and short-run asymmetry respectively. P-value is reported for portmanteau and Jarque-bera test

5. Discussion

The RCEP is of value to ASEAN because it addresses concerns about the “noodle bowl” effect (Baldwin, 2007; Chaise and Hamanaka, 2018). ASEAN is an economically vibrant region, and its trade and investment potential can be further improved through the RCEP since it will overcome any existing restrictions that hinder economic cooperation with its main economic partners. Two outstanding issues that will be resolved through this arrangement are non-tariff barriers and rules of origin. As it stands, companies have to deal with the complexities of multiple rules of origin as are associated with the different trade agreements that prevail. The RCEP offers the promise of a standard set of rules. ASEAN member states, generally, have very low tariff rates, with Malaysia having rates that are as close to zero as possible for most tariff lines. Thus, lowering tariff rates will not deliver any additional gains. The next course of action will, therefore, be to attend to the non-tariff barriers, a matter that RCEP would be expected to address.

As a consequence of the RCEP, it can be expected that there will be smoother integration of global value chains (Athukorala, 2016). ASEAN member states are active participants in GVC networks. This is particularly true for Malaysia, Indonesia, Thailand and Vietnam. Multinational corporations are able to take advantage of GVCs and they have the resources to deal with the distinct requirements of the different trade arrangements. This is not the case with the small and medium enterprises (SMEs) which can find an important role to play within the RCEP arrangement (Chaise and Pomfret, 2019). Small and Medium Enterprises (SMEs) play a prominent role in the economic activity of Malaysia, since about 98 per cent of business establishments are SMEs. It stands to reason that RCEP will favour the SMEs, leading them to increase their contribution of value-added to the national economy.

In view of the advantages that the RCEP can possibly offer by way of the facilitation of trade and investment, Malaysia should position itself favourably. In policy terms, this has several implications. First, the government can attempt to take advantage of Malaysia’s level of development, areas of competitive advantage and geographical position to gain from membership in RCEP. Malaysia can position itself as the ‘hub’ of ASEAN, since in this manner it will be possible to take advantage of the gains from trade and investment arising out of RCEP. Second,

Malaysia should further develop the SME sector as this will enable the companies in the sector to be a part of the supply chain networks. Specifically, SMEs will be better able to integrate themselves in GVCS if they have adequate technological upgrading and technically skilled workers.

Policy makers in Malaysia should also consider how they can take advantage of the country's trade and investment connections with its traditional trade partners such as Japan, China and South Korea, while also improving intra-ASEAN links. As far as investment is concerned, it is important for Malaysia to have a set of more competitive investment policies and incentives given the increased competition for investment. This will be necessary if Malaysia is to be converted into a hub for investment in ASEAN, so as to take advantage of RCEP in attracting investments.

There will, of course, be concern that with RCEP, ASEAN would lose its centrality since China is a member of the trade arrangement. The reason for this fear is because China is the most powerful member of RCEP and there is concern that China's presence could dilute ASEAN centrality. However, this might be ill-founded because RCEP is based on the agreement, at the core of which are the ASEAN member states, without whose approval China will not be able to pursue its independent agenda.

Further, RCEP could be the first step towards deeper regional integration in so far as it heads towards Free Trade Area of the Asia Pacific (FTAAP). The idea of moving towards FTAAP has been mooted by FTAAP and by APEC, too. In the light of these aspirations, RCEP is a positive step in that direction. As far as Malaysia is concerned, if it is able to position itself and implement effective policies to attract investment and facilitate trade it will take advantage of RCEP and prepare itself for the deeper integration that will follow.

6. Conclusion

This study compares the growth-enhancing effect of the RCEP and CPTPP agreements for Malaysia's economy. Based on data from November 2012 to August 2019, the NARDL results indicate that: First, total export to member countries of RCEP is found to have a long-run relationship with Malaysia's Industrial Production Index (IPI). However,

there is no cointegration relationship between IPI and total export to member countries of CPTPP. Second, the growth-enhancing effect of RCEP is found to be greater than CPTPP. Third, the results obtained for RCEP are robust even with the absence of Malaysia's major trading partners in the RCEP agreement.

The results have important implications as to which FTAs Malaysia should participate in. Based on the results, RCEP is found to play an important role in facilitating Malaysia's long-term economic growth as opposed to CPTPP. This is reasonable because the advantage of RCEP over CPTPP is that it retains ASEAN centrality. This is expected to improve further the flow of goods and services among countries, thereby achieving higher economic growth among the member countries of RCEP.

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A method for preparing multi-regional input-output tables despite data limitation: FLQ-Gravity

Farhad Tarahomi¹ and Fatemeh Bazzazan²

ABSTRACT

The preparation of multi-regional input-output tables is of great importance because of its multiple applications. However, due to the lack of data in many developing countries, including Iran, its preparation faces serious challenges. To deal with these challenges, this paper introduces the FLQ-Gravity combination method. The contribution of this research is the use of the basic model of gravity. When there is no interregional trade data, this model can partially estimate interregional trade based on the three factors of production, demand and distance. For this purpose, first, a single region input-output table is prepared by FLQ method. Then, trade between regions is estimated using the gravity method. In the experimental section, the multi-regional input-output table (Tehran, oil-rich regions, and the rest of economies for Iran is prepared using the above method. Then, modeling and calculation are performed on multipliers coefficients and spillover & feedback effects.

ملخص

يكتسي إعداد جداول متعددة المدخلات والمخرجات الإقليمية أهمية كبيرة بسبب تطبيقاتها المتعددة. ولكن بسبب نقص البيانات في عدد من البلدان النامية، بما فيها إيران، فإن إعدادها يواجه تحديات جدية. ولمواجهة هذه الأخيرة، تقدم هذه الورقة أسلوب الجمع بين حاصل الموقع لفلغ والجاذبية (FLQ-Gravity). وتتمثل مساهمة هذا البحث في استخدام النموذج الأساسي للجاذبية. فعندما لا توجد بيانات تجارية أقاليمية، يمكن لهذا النموذج أن يقدر جزئياً التجارة الأقاليمية استناداً إلى

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العوامل الثلاث المتمثلة في الإنتاج والطلب والمسافة. ولهذا الغرض، يتم أولاً إعداد جدول إقليمي للمدخلات والمخرجات حسب أسلوب حاصل الموقع لفليغ. ثم يتم تقدير التجارة بين المناطق باستخدام طريقة الجاذبية. ففي القسم التجريبي، يتم إعداد جدول المدخلات والمخرجات بين المناطق المتعددة (طهران، المناطق الغنية بالنفط، وبقية الاقتصادات بالنسبة لإيران) باستخدام الطريقة المذكورة أعلاه. ثم، يتم النمذجة والحساب على معاملات المضاعفات والتأثيرات غير المباشرة والمرتبطة.

ABSTRAITE

La préparation de tableaux d'entrées-sorties multirégionaux revêt une grande importance en raison de ses multiples applications. Cependant, en raison du manque de données dans de nombreux pays en développement, dont l'Iran, sa préparation est confrontée à de sérieux défis. Pour faire face à ces défis, cet article introduit la méthode de combinaison FLQ-Gravity. La contribution de cette recherche est l'utilisation du modèle de base de la gravité. Lorsqu'il n'existe pas de données sur le commerce interrégional, ce modèle permet d'estimer partiellement le commerce interrégional sur la base des trois facteurs que sont la production, la demande et la distance. À cette fin, un tableau d'entrées-sorties pour une seule région est d'abord préparé par la méthode FLQ. Ensuite, le commerce entre les régions est estimé en utilisant la méthode de gravité. Dans la section expérimentale, le tableau des entrées-sorties multirégional (Téhéran, régions riches en pétrole et le reste des économies pour l'Iran) est préparé en utilisant la méthode ci-dessus. Ensuite, la modélisation et le calcul sont effectués sur les coefficients des multiplicateurs et les effets d'entraînement et de rétroaction.

Keywords: Multi-regional input-output table; Location quotient method; Gravity model; Spillover effects; Feedback effects

JEL Classification: C67, R15, R12

1. Introduction

The input-output model is one of the economic policy-making models that can make policies at the national and regional levels. Regional tables are prepared as single-regional, inter-regional, and multi-regional (three-regional and more) tables. The calculation of multi-regional input-output coefficients is of great importance for determining the multipliers coefficients and spillover and feedback effects. The main challenge in using this model is its preparation despite the lack of data at the regional

level. In this regard, researchers have prepared a multi-regional table based on data available in their country (e.g., Yamada (2015) in Japan and Boero et al. (2018) in Germany). Regarding the lack of data at the regional level in most developing countries (including Iran), researchers have to prepare multi-regional input-output tables, taking into account the above limitations. In this regard, Isard (1951) states: “Multiregional Input-Output tables usually need to be estimated due to the unavailability of subnational level data”.

In addition, the type of input-output table preparation varies according to its application. The location quotient is a suitable method when the goal is to analyze the production, employment, and structural changes of one or more regions (Flegg and Tohmo, 2018). Flegg Location Quotient (FLQ) is the most appropriate method of location quotient. This method simultaneously accounts for the size of the selling sectors, the size of the purchasing sectors, and the size of the region (Kowalewski, 2015). The focus of FLQ is on the output generated within a specific region. So, it should be only being used in conjunction with national IO tables where the inter-industry transactions exclude imports.

Calculating inter-regional trade is another important issue in the preparation of multi-regional input-output tables. Gravity is one of the models that are widely used today in calculating the trade (export and import) coefficients of multi-regional input-output. In recent years, the gravity model has become a workhorse for quantitative studies of international trade and investment policy. This model is based on Newton’s theory of Gravity and states that more Gravity means more trade between regions. The amount of inter-regional trade depends on the level of production, demand, and the distance between them (Miller and Blair, 2009). The Gravity model was first introduced into the regional input-output literature by Leontief and Strout (1963). So far, various modifications have been made to the Gravity model according to the available data of the countries, some of which can be found in the studies conducted by Boero et al. (2018) in the United States, Krebs (2018) in Germany and Yamada (2015) in Japan.

Given the time series data of inter-regional and intra-regional trade in these countries, the model of Gravity can be expanded. In other words, given the data of interregional trade and production of economic sectors in United States, Germany and Japan, the authors have been able to

estimate the elasticity (coefficient) of each of these factors and thus provide a modified type of gravity model¹. However, this is not the case in many developing countries such as Iran. In contrast to international trade, it is still difficult to find regional trade statistics within Iran. Given that the gravity model continues to be very popular and suitable, it is used in this research. An important contribution of the present paper is the preparation of a multi-regional input-output table, despite a lack of inter-regional and intra-regional trade statistics. The focus of the present study is on the innovative approach proposed by Tarahomi and Bazzazan (2020) in Iran. In this approach, two methods of estimation (i.e., the FLQ and the Gravity) are combined to estimate the intraregional and interregional transactions, respectively. A key facet of this approach is the use of the FLQ in estimating intraregional trade and a Gravity model in estimating interregional trade. Hence, the regionalization process comprises two steps: the estimation of intra-regional flows and interregional trade. Intra-regional flows are calculated by the FLQ method and interregional trade flows by the gravity method. In general, this paper provides empirical evidence for the applicability of the FLQ-Gravity method to three regions of Iran. The first objective of this paper is to introduction and use of the combined method of FLQ and gravity methods in order to construct a multi-regional input-output table. The second goal is to model a multi-regional input-output table to determine the effects of spillover and feedback in the three regions. Spillover and feedback effects are important interregional interactions. The spillover effects can be traced back to the theories of economic equilibrium and non-equilibrium development. In the 1950s, economists focused on the growth pole and put forward the spillover effects of the center to the periphery. With the development of new economic growth theory, Romer (1986) and Robert (1988) proposed that the spillover effects are the exogenous economic essence. The economic spillover effects refer to the unidirectional influence of the economic development of one region on the economic development of other regions. The feedback effects are the influence of other regions on the development of the region (Li et al, 2018). Multi-regional input-output models are one of the most widely used approaches to analyze the economic interdependence between different regions. The main question of this research is how in the lack of trade data between regions, gravity method can help to build a multi-regional input-output table. Unfortunately, the previous studies in Iran suffer from several limitations.

¹ In the Gravity Model section, this point will be discussed more.

Most of them have used single-region and two-region input-output tables, and multi-regional analysis has not been performed in Iran. Meanwhile, Iran has 30 provinces that have different economic structures and play different roles in economic growth. The remainder of this paper is organized as follows. In Section 2, the theoretical background of the FLQ and Gravity is briefly recalled. Then, the combination of FLQ and Gravity methods is explained. Modeling multipliers coefficients and spillover & feedback effects in a multi-regional input-output table are described in Section 3. In Section 4, a multi-regional table is prepared and multipliers coefficients and spillover and feedback effects are calculated. Finally, in Section 5, the results and suggestions are presented.

2. Literature Review

As mentioned in the introduction, the method used is a combination of FLQ and Gravity methods. First, the FLQ method is explained and then the Gravity method is discussed. In this research, the following data are used to construct a multi-region input-output table:

- Input-output table of Iran. The latest table published in Iran is related to the year 2011.
- Statistics of intermediate consumption, value added and output of 18 economic sectors are studied. The above data has been published by the Statistics Center of Iran.
- Statistics related to the ground distance of the centers of the studied provinces (for use in the gravity model)¹.

2.1. FLQ method

Where regional IO tables are unavailable, survey-based methods are surely the most reliable way of producing them, yet this would go well beyond the time and funding limits of most research projects. A simple and cheap alternative is to employ LQ-based techniques. In applying LQ, the national transactions matrix is first transformed into an input coefficient matrix. LQ-based techniques assume that the intraregional input coefficients in any region (b_{ijr}), depend on the corresponding national input coefficients (a_{ijr}), as follows:

¹ It should be noted that in all research in the field of input-output, the mentioned data has been used.

$$b_{ijr} = LQ_{ijr} * a_{ijr} \quad (1)$$

Here b_{ijr} can be interpreted as the amount of input from sectors i in region r that is required by sector j in that region to produce one unit of gross output.

LQ_{ijr} represents an LQ-based formula, such as the FLQ, the simple LQ (SLQ) or cross industry LQ (CILQ). Formula (1) entails that, where $LQ_{ijr} \geq 1$ the intraregional coefficients are equated to the corresponding national coefficients. Otherwise, the b_{ijr} are adjusted downwards to take account of inputs imported from other regions (Kowalewski, 2015). The SLQ is defined here as:

$$SLQ_i^r = \frac{Q_i^r / Q^r}{Q_i / Q} \quad (2)$$

Where Q_i^r denotes the output of regional sector i , while Q_i is the corresponding national figure. Q^r and Q represent the overall output of region r and the nation. The CILQ is defined as:

$$CILQ_{ij}^r = \frac{SLQ_i^r}{SLQ_j^r} \quad (3)$$

Where i and j refer to the supplying and purchasing sectors, respectively. As is customary, where $i=j$, we have set $CILQ_{ij}^r = SLQ_i^r$.

However, Empirical research has demonstrated that the SLQ, CILQ and related formulae tend to understate a region's imports from other regions and hence tend to overstate multiplier effects (Flegg & Tohmo, 2013). The FLQ aims to overcome this shortcoming by taking regional size into account. The FLQ is defined here as:

$$FLQ_{ij}^r = CILQ_{ij}^r * \lambda^r \quad (4)$$

Where

$$\lambda^r = [\log_2(1 + Q^r / Q)]^\delta \quad (5)$$

Q^r/Q Measures regional size in this equation, while the parameter δ controls its convexity. It is assumed that $0 \leq \delta < 1$. As δ rises, so too does the allowance for imports (from other regions or from abroad). $\delta=0$ represent a special case where $FLQ_{ij}^r = CILQ_{ij}^r$.

The value of δ is calculated by various methods and using data available in each country. For example, Kowalewski (2015) has used an econometric equation to estimate its value for each segment (Malte et al, 2018). The FLQ method is used to prepare single-regional input-output tables. Besides, to prepare inter-regional trade, the method of Gravity is required, which is discussed below.

2.2. Gravity Model and its compliance with Iranian economic data

The model of Gravity introduced by Leontief & Strout (1963) is in the form of Eq. (6) (Miller & Blair, 2009).

$$T_i^{rs} = \frac{X_i^r * X_i^s}{X_i} * Q_i^{rs}, \quad Q_i^{rs} = \frac{k_i^{rs}}{(d^{rs})^{e_i}} \quad (6)$$

Where T_i^{rs} is the intra-regional trade exchange of sector i between the two regions r and s . X_i^r is the total supply of sector i in region r . X_i^s is the total demand of sector i in region s . X_i is the total production in sector i in two regions. Q_i^{rs} is a component that consists of two elements k_i^{rs} and d^{rs} . k_i^{rs} is a constant coefficient element. d^{rs} is the distance between two regions r and s . e_i is also a distance power (elasticity). Using this equation, due to data limitations and experimental studies, faces the following constraints¹:

¹ In fact, it can be said that in this section, the simplification of the gravity model has been done according to the available data in the Iranian economy. This section covers the gap caused by the lack of trade data between regions. Obviously, it can be used for countries that have such a situation in terms of statistics.

a) In this equation, the amount of supply elasticity and demand elasticity is considered equal to 1. However, according to recent input-output research, this issue has been reviewed and researchers have defined each of the variables of Eq. (6) with separate power (elasticity) for each sector (Li et al. 2018; Krebs et al. 2018). Considering a separate elasticity for each region is because the impact of demand and supply varies according to factors such as consumption and taste (on the demand side) and technology and production structure (on the supply side).

b) In Eq. (6), determining the value of k_i^{rs} is a challenging issue. Experimental studies show that its value is considered constant between different sectors of a region and between different regions.

c) Determining the value of distance elasticity (the value of e_i) is another challenge of using the Gravity model. According to most experimental studies, its value is considered as unity (Anderson, 2011 and 2016; Chaney, 2011).

d) It is difficult to determine the distance when several provinces are studied in the form of a region. In this research, according to experimental studies, to determine the distance, the arithmetic average distance of provincial centers is used.

Despite the above constraints, using this method has the following advantages:

1) It is possible to create multi-regional input-output tables using this method.

2) Since the Gravity model calculates the trade relationship between the two regions well, it can also be used to prepare multi-region input-output tables from which the national economy is not obtained.

The Gravity model has been used in many new studies, which are referred to below.

Gabela (2020) in an article examining the method of gravity in Japan. Results show high overall accuracy levels for this approach. Due to the existence of intraregional and interregional trade statistics in Japan, the author has been able to estimate the coefficient (elasticity) of each of the elements of Equation (6) in this article.

Kerbs (2018) has used Equation 6 of this research to prepare a multi-regional input-output table in Germany. Elasticity of production and demand in the model of gravity is considered equivalent to a unit, but the elasticity of distance is estimated by econometric method. The elasticity of the distance between economic sectors is calculated from 1.07 to 2.87.

Mi et al. (2018) prepared the 30 regional input-output table of China for 2012 using the gravity method. They have used Equation 6 of this research and the production, demand and distance elasticity for each sector have been estimated.

Safr & Sixta (2018) has examined trade between different regions of the Czech Republic using various models including gravity. They have used Equation 6 of this research and have estimated production, demand and distance elasticity using econometric model.

As mentioned, due to the lack of time series trade data between regions in Iran, econometric estimation is not possible. Therefore, Equation 6 is used to estimate trade between regions. In addition, in the Japan, Germany, China and Czech Republic countries (Which were mentioned in the above studies) there is cross-country trade data (due to being in the global input-output table) and it is possible to expand the model. While such an issue does not apply to the Iranian economy.

2.3. The framework of Gravity-FLQ method

To explain the Gravity-FLQ method, the multi-region table structure of this research is introduced. To this aim, first, the single-regional input-output table of each of the mentioned regions is prepared by the FLQ method using Eqs. (1) to (5). The structure of the single-regional table obtained according to the available data in the Iranian economy is presented in Table 1.

Table 1: Structure of single-regional input-output table used in research

Intermediate goods and services (internal)	Final demand (internal)	Output
Intermediate import from other regions in the country		
Intermediate import from foreign		
Value added		
Output		

As can be seen, the first area of the used single-regional table only includes internal intermediate exchanges of the same region. The final demand is the same. The Gravity-FLQ method emphasizes the intermediate imports from other regions of the country, which is the basis of distribution. Using the Gravity method, the amount of intermediate imports from other regions of the country is distributed¹. Table 2 shows the structure of the multi-regional input-output table of the present research.

¹ In this section, the structure of Iran's single-regional input-output table is explained. Obviously, in other countries, the relationship between gravity can be used according to the available trade statistics between regions.

Table 2: The structure of the multi-regional table of the research

	Oil-rich regions	Tehran	The rest of economies	Final demand (internal)	Output
Oil-rich regions	Z^{OO}	Z^{OT}	Z^{OR}	Y^O	X^O
Tehran	Z^{TO}	Z^{TT}	Z^{TR}	Y^T	X^T
The rest of economies	Z^{RO}	Z^{RT}	Z^{RR}	Y^R	X^R
Intermediate import from	M^O	M^T	M^R		
Value added	V^O	V^T	V^R		
Output	X^O	X^T	X^R		

In Table 2:

Z^{OO} is the square matrix of intra-regional intermediate exchanges within the oil-rich regions of Iran.

Z^{OT} is the matrix of inter-regional exchanges with the origin in oil-rich regions and the destination in Tehran.

Z^{OR} is the matrix of inter-regional exchanges with the origin in oil-rich regions and the destination in the rest of economies.

Z^{TO} is the matrix of inter-regional exchanges with the origin in Tehran and the destination in the oil-rich regions of Iran.

Z^{TT} is the square matrix of intra-regional intermediate exchanges with in Tehran.

Z^{TR} is the matrix of inter-regional exchanges with the origin in Tehran and the destination in the rest of economies.

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Z^{RO} is the matrix of inter-regional exchanges with the origin of the rest of economies and the destination of the oil-rich regions of Iran.

Z^{RT} is the matrix of inter-regional exchanges with the origin of the rest of economies and the destination of Tehran.

Z^{RR} is the square matrix of intra-regional intermediate exchanges of the rest of economies.

Y^O is the column vector of domestic final demand for oil-rich regions, which includes household consumption, government expenditure, investment, and changes in inventory.

Y^T is the column vector of final domestic demand for Tehran that includes household consumption, government expenditure, investment, and changes in inventory.

Y^R is the column vector of the final domestic demand for the rest of economies, which includes household consumption, government expenditure, investment, and changes in inventory.

M^O , M^T and M^R are the import row vectors outside the oil-rich regions, Tehran, and the rest of economies, respectively.

V^O , V^T , and V^R are the value-added row vectors of oil-rich regions, Tehran, and the rest of economies, respectively.

X^O , X^T , and X^R are the output row vectors of oil-rich regions, Tehran, and the rest of economies, respectively.

The data in this section are as follows: Matrices Z^{OO} , Z^{TT} and Z^{RR} are calculated using FLQ method. Matrices Z^{OT} , Z^{OR} , Z^{TO} , Z^{TR} , Z^{RO} and Z^{RT} are calculated using GRAVITY method.

Matrix of intermediate import from foreign each region is obtained according to the ratio of region to country output in each sector.

Matrices Value added and Output are obtained from the Statistics Center of Iran.

Matrix of Final demand (internal) each region is obtained by reducing the sum of intermediate demands from the output.

The Gravity-FLQ method for constructing a multi-region input-output table is as follows:

A. Calculating the main diagonal matrices in the first area of the table, which represents the intra-regional exchange matrices. This area is estimated using the FLQ method.

B. Applying the model of Gravity according to Eq. (6): In this way, the intra-regional intermediate trade between the oil-rich regions (O) of the two regions of Tehran (T) and other national economies (R) is determined as Eqs. (7) and (8):

$$T_i^{TO} = \frac{X_i^T \times X_i^O}{X_{T+O}} * Q_i^{TO} \quad (7)$$

$$T_i^{RO} = \frac{X_i^R \times X_i^O}{X_{R+O}} * Q_i^{RO} \quad (8)$$

Q_i of each of Eqs. (7) and (8) is obtained using the output figures of the sectors and the distance between the centers of the mentioned regions. Therefore, the value of intermediate trade between the two oil-rich regions and Tehran (Eq.7) and the oil-rich region with other national economies (Eq. 8) is obtained separately and according to the equation of Gravity.

C. The relationship between the location quotient method and the Gravity model is established as follows. Intermediate imports calculated in the

single-regional table (intermediate imports from other regions of the country) are distributed using the Gravity method. The intermediate import vector of oil-rich regions is distributed from the two regions of Tehran and other national economies according to Eqs. (9) and (10). So,

$$m_i^{TO} = \frac{T_i^{TO}}{T_i^{RO} + T_i^{TO}} * m_i^O \quad (9)$$

$$m_i^{RO} = \frac{T_i^{RO}}{T_i^{RO} + T_i^{TO}} * m_i^O \quad (10)$$

In Eqs. (9) and (10), m_i^{TO} , m_i^{RO} , and m_i^O are respectively the intra-regional intermediate imports of oil-rich regions from Tehran, the intra-regional intermediate imports of oil-rich regions from other national economies, and the value of intermediate imports of oil-rich regions. Eqs. (9) and (10) show the share of imports of oil-rich regions from the two regions of Tehran and other national economies. Since the values obtained from Eqs. (9) and (10) are row vectors, Eqs. (11) and (12) are used to construct the imports matrix (Ngo et al. 1986).

$$m^{TO} = A^{OO} * \text{diag } m^{TO} \quad (11)$$

$$m^{RO} = A^{OO} * \text{diag } m^{RO} \quad (12)$$

where $\text{diag } m^{TO}$, A^{OO} , and m^{TO} indicate the diagonal matrix of intermediate imports of oil-rich regions from Tehran, the technical coefficient matrix of oil-rich regions (importing region), and the intermediary import matrix of oil-rich regions from Tehran, respectively. Eq. (12) is the same as Eq. (11), except that it represents the import of oil-rich regions from other national economies. The inter-regional exchange matrices of Z^{TO} and Z^{RO} are calculated from Eqs. (13) and (14), respectively.

$$Z^{TO} = m^{TO} * \text{diag } X^O \quad (13)$$

$$Z^{RO} = m^{RO} * \text{diag } X^O \quad (14)$$

Where $\text{diag } X^O$ is the output diagonal matrix of the oil-rich regions and the rest of the symbols have already been defined.

It is of note that the concept of Z is different from T in the above relations. T denotes the amount of trade that can exist between the two regions taking into account the three factors of production, demand, and distance, while Z shows the amount of trade between the two regions in addition to the above three factors, taking into account the sum of intermediate costs and intermediate demand.

2.4. Modeling multipliers coefficients and spillover & feedback effects in a multi-regional input-output table

In applied research, it is common to turn the input-output table into a model. For this purpose, the accounts in the table should divide into two categories: endogenous and exogenous. Intermediate exchanges (the first area of the table) are considered endogenous while final demand (the second area) and value-added (the third area) are considered exogenous. To derive a static multi-regional input-output model based on Table 2, we can write:

$$\begin{aligned} X^O &= A^{OO}X^O + A^{OT}X^T + A^{OR}X^R + Y^O \\ X^T &= A^{TO}X^O + A^{TT}X^T + A^{TR}X^R + Y^T \end{aligned} \quad (15)$$

$$X^R = A^{RO}X^O + A^{RT}X^T + A^{RR}X^R + Y^R$$

Using the assumption that the production function is linear, intra-regional technical coefficients and inter-regional trade coefficients can write as follows:

$$\begin{aligned} A^{OO} &= Z^{OO}(X^O)^{-1}A^{TR} = Z^{TR}(X^R)^{-1}A^{OT} = Z^{OT}(X^T)^{-1} \\ A^{TT} &= Z^{TT}(X^T)^{-1}A^{RT} = Z^{RT}(X^R)^{-1}A^{TO} = Z^{TO}(X^O)^{-1} \\ A^{RR} &= Z^{RR}(X^R)^{-1}A^{RO} = Z^{RO}(X^O)^{-1}A^{OR} = Z^{OR}(X^R)^{-1} \end{aligned} \quad (16)$$

Where matrices A^{OO} , A^{TT} , and A^{RR} show the intra-regional technical coefficients of oil-rich regions, Tehran, and other national economies,

respectively. Also, matrices A^{TR} , A^{RT} , A^{OT} , A^{RO} , A^{TO} , and A^{OR} are inter-regional trade coefficients. If (16) is substituted in (15) and is written in the form of a matrix, (17) is obtained as follows.

$$\begin{pmatrix} X^O \\ X^T \\ X^R \end{pmatrix} = \begin{pmatrix} A^{OO} & A^{OT} & A^{OR} \\ A^{TO} & A^{TT} & A^{TR} \\ A^{RO} & A^{RT} & A^{RR} \end{pmatrix} \begin{pmatrix} X^O \\ X^T \\ X^R \end{pmatrix} + \begin{pmatrix} Y^O \\ Y^T \\ Y^R \end{pmatrix} \quad (17)$$

If Eq. (17) arranged according to the endogenous variables of the model, we will have:

$$\begin{aligned} \begin{pmatrix} X^O \\ X^T \\ X^R \end{pmatrix} &= \left[\begin{pmatrix} I & 0 & 0 \\ 0 & I & 0 \\ 0 & 0 & I \end{pmatrix} - \begin{pmatrix} A^{OO} & A^{OT} & A^{OR} \\ A^{TO} & A^{TT} & A^{TR} \\ A^{RO} & A^{RT} & A^{RR} \end{pmatrix} \right]^{-1} \begin{pmatrix} Y^O \\ Y^T \\ Y^R \end{pmatrix} \\ &= \left[\begin{pmatrix} I - A^{OO} & -A^{OT} & -A^{OR} \\ -A^{TO} & I - A^{TT} & -A^{TR} \\ -A^{RO} & -A^{RT} & I - A^{RR} \end{pmatrix} \right]^{-1} \begin{pmatrix} Y^O \\ Y^T \\ Y^R \end{pmatrix} \end{aligned} \quad (18)$$

Eq. (18) can be written in the matrix form as follows:

$$X = B * Y \quad (19)$$

Where X is the output vector, Y is the final demand vector, and B is Leontief multi-regional inverse matrix. In the main multi-regional model of relation (19), matrix B can be extended as follows:

$$B = \begin{pmatrix} B^{OO} & B^{OT} & B^{OR} \\ B^{TO} & B^{TT} & B^{TR} \\ B^{RO} & B^{RT} & B^{RR} \end{pmatrix} \quad (20)$$

Matrix (20) can be divided into three sub-matrices, each representing a specific effect.

$$\begin{aligned}
B &= \begin{pmatrix} B^{OO} & B^{OT} & B^{OR} \\ B^{TO} & B^{TT} & B^{TR} \\ B^{RO} & B^{RT} & B^{RR} \end{pmatrix} \\
&= \begin{pmatrix} (I - A^{OO})^{-1} & 0 & 0 \\ 0 & (I - A^{TT})^{-1} & 0 \\ 0 & 0 & (I - A^{RR})^{-1} \end{pmatrix} + \begin{pmatrix} 0 & B^{OT} & B^{OR} \\ B^{TO} & 0 & B^{TR} \\ B^{RO} & B^{RT} & 0 \end{pmatrix} \\
&+ \begin{pmatrix} B^{OO} - (I - A^{OO})^{-1} & 0 & 0 \\ 0 & B^{TT} - (I - A^{TT})^{-1} & 0 \\ 0 & 0 & B^{RR} - (I - A^{RR})^{-1} \end{pmatrix}
\end{aligned}$$

According to matrix analysis, three effects can be distinguished:

The first component shows the effect of multipliers coefficients of production. This effect is obtained from the column sum of the elements of the matrices, $(I - A^{OO})^{-1}(I - A^{TT})^{-1}$ and $(I - A^{RR})^{-1}$ and shows the direct and indirect effect of the change in the final demand of each region on the production of that region.

The second component describes the spillover effects. This effect is obtained from the column sum of the non-diagonal elements of matrix B , which shows the effect of the change in the final demand of one region on the production of other regions.

The third component includes feedback effects. This effect is obtained by summing the elements of the matrices $B^{OO} - (I - A^{OO})^{-1}$, $B^{TT} - (I - A^{TT})^{-1}$, and $B^{RR} - (I - A^{RR})^{-1}$. Feedback effects represent the recursive production effects caused by spillover effects. For example, according to the subject of research, the spillover effects caused by increased production in Tehran province on two other regions

(oil-rich regions and the rest of economies) increase production in Tehran province, which is called the feedback effect (Meng & Qu, 2007).

3. Empirical Results

3.1. Calculation of average multipliers coefficients, spillover and feedback effects

Table 3 shows the results of average multipliers coefficients, spillover effects, and feedback effects of the three study areas. This section was calculated using Eq. (20) and decomposition of the Leontief inverse matrix into three components of multipliers coefficients, spillover effects and feedback effects.

Table 3: Average multipliers coefficients, spillover & feedback effects of the three study regions

Region	Multipliers	Effect of spillover on oil-rich regions	Effect of spillover on the rest of economies	Effect of spillover on Tehran	Total of spillover effects	Feedback effects
Tehran	1.09	0.05	0.38	---	0.42	0.04
Oil-rich regions	1.21	---	0.22	0.05	0.27	0.02
The rest of economies	1.44	0.04	---	0.05	0.09	0.04

Source: Research Calculations

The results of Table 3 show that the highest multipliers coefficient is related to the region of the rest of economies. In other words, if the final demand in this region increases by one unit, the average production in the whole region will increase by 1.44 units. This result shows that intra-regional ties are stronger in the rest of economies than in the other two regions. The total effects of spillover in Tehran province are more than the other two regions because this region is smaller than the other two regions. The distribution of spillover effects is in line with the size and multipliers coefficient of the region. For example, the spillover effects of oil-rich regions have led to a higher increase in production in the rest of economies than in Tehran province (comparing 0.22 and 0.05). The region of the rest of economies during the period 2011-2016 accounted for about 50% of the production of the national economy. Meanwhile, the share of Tehran province was 20.5% during this period. Besides, the

average multipliers coefficients in the region of the rest of economies are higher than in Tehran province. The same is true for the other two regions. The feedback effects obtained are less than the spillover values. This result is consistent with international studies such as Diazenbacher (2002). Considering the value of 0.02 related to the feedback effects of oil-rich regions, it can be said that with the increase of final demand in this region by one unit, production will increase by an average of 0.27 units in Tehran and the rest of economies. The increase in the above two regions, on average, causes 0.02-unit increase in oil-rich regions.

3.2. Calculation of Spillover effects of the first to third-ranked sectors in three study regions

To provide the desired report, the three sectors that have the most spillover effect are examined in Table 4. In Table 4, the rows represent the change in final demand in the region and the columns show the increase in production in the region (because of the change in final demand in another region). For example, the intersection of the final demand line of the rest of economies and the Tehran column reflects the spillover effects of the rest of economies on Tehran province.

The results of spillover effects between regions show that in the Tehran region and among the studied sectors, the industrial sector has the most spillover effects on the other two regions. With a 1-unit increase in the investment in the industrial sector of Tehran, the production of the industrial sector in oil-rich regions changes by 0.15 units and in the rest of economies by 0.90 units. The construction sector in Tehran province also has significant spillover effects. The reason for this result is the dependence of Tehran's economy on two other regions (especially the rest of economies) in this sector. Tehran province has the third-highest dependence in electricity, gas, and water production sector. In oil-rich regions, the construction sector has the most spillover effects. With a 1-unit increase in the investment in the construction sector of this region, production in Tehran province will increase by 0.10 units and in the rest of economies by 0.47 units. The spillover effects of the agricultural sector

of this region are also significant. With a 1-unit increase in investment in the agricultural sector in oil-rich regions, production in the rest of economies will increase by 0.43 units. The greatest spillover effect of the rest of economies on Tehran is related to the information and communication services sector. The next ranks are for industry, financial services, and insurance. Meanwhile, the greatest spillover effect of the rest of economies on oil-rich regions is related to the industrial sector, followed by mining and construction. In general, the inter-regional spillover effects show that most of the activities related to information and communication services and financial and insurance services take place in Tehran province. Besides, the construction sector plays an important role in inter-regional spillover effects. Construction of roads, railways, urban utility projects, construction of electricity, gas, and water networks and related services are among the sub-activities of the construction sector that play an important role in inter-regional trade.

Table 4: Spillover effects of the first to third-ranked sectors in three study regions

Region	Tehran	Oil-rich regions	The rest of economies
Tehran	---	Mining:0.15 Industry: 0.15 Electricity, Gas, and Water Production: 0.13	Industry: 0.90 Construction: 0.71 Electricity, Gas, and Water Production: 0.57
Oil-rich regions	Construction: 0.10 Communication Services: 0.10 Financial and Insurance Services: 0.08	---	Construction: 0.47 Agriculture:0.43 Water Supply:0.40
The rest of economies	Communication Services: 0.17 Industry: 0.12 Financial and Insurance Services: 0.08	Industry: 0.14 Mining:0.13 Construction: 0.07	---

Source: Research Calculations

3.3. Calculation of feedback effects of the first to third-ranked sectors in three study regions

Table 5 shows the results of the feedback effects of the three studied sectors in the three regions. The calculations in this section are performed using the third component of Eq. (20).

Table 5: Feedback effects in three study regions

Region	Tehran	Oil-rich regions	The rest of economies
Tehran	Construction: 0.09 Mining: 0.07 Communication Services: 0.07	---	---
Oil-rich regions	---	Industry: 0.05 Construction: 0.05 Water Supply: 0.03	---
The rest of economies	---	---	Industry: 0.13 Construction: 0.08 Communication Services: 0.07

Source: Research Calculations

In Tehran province, the most feedback effect is related to the construction sector. Therefore, if the final demand of the construction sector in Tehran province increases by one unit, it will increase production in the rest of economies and in oil-rich regions. The increase in production in the other two regions leads to a 0.09-unit increase in the region itself.

4. Conclusion and Policy Implications

The main purpose of this study was to construct an input-output table of three important economic regions of Iran and to investigate their interaction with each other. For this purpose, first, three-region input-output table was prepared using FLQ-GRAVITY method. In this paper,

due to the lack of interregional trade data in the Iranian economy, the basic model of gravity was used. However, in studies conducted in developed countries such as Krebs (2018) in Germany, the elasticity of each component of the gravity model is estimated with econometric models. The amount of trade between regions and their interdependence is measured using the effects of spillover and feedback in the form of a multi-regional input-output table. The results showed that Tehran (the capital of Iran) has the highest spillover effect among the three regions studied. In other words, it is most dependent on the production of the other two regions of Iran (oil-rich regions and the rest of economies). Among the economic sectors of Tehran province, industry has the most dependence. In addition, the results of the spillover effects show that Communication Services and Financial and Insurance Services are concentrated in Tehran. In general, the effects of spillover and feedback between regions on the Iranian economy are significant. Therefore, like the results of research by Zang (2017) and Li et al. (2018) in China, these effects should also be considered in policy-making in the Iranian economy.

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How do EFI and CPI impact Foreign Direct Investment (FDI) inflows in Selected Emerging Markets?

Mehmet Çanakcı¹

ABSTRACT

This study examines the determinants of foreign direct investment in certain countries in emerging markets. The most distinctive feature that distinguishes this empirical research from its peers is that it includes the EFI (Economic Freedom Index) and CPI (Corruption Perception Index) scores as the explanatory variable in the model. After cross-section dependency tests and unit root tests, long and short-term parameters were estimated by ARDL model. The empirical method was employed on data set during the period 1997-2018 to determine the impact of economic freedom index and corruption perceptions index on foreign direct investment in selected emerging markets. The empirical results show that the relationship between corruption perceptions index and foreign direct investment is a positive, The effect of CPI was found to be significant among the long-term parameters, and an increase of 1% significant level increases FDI by 7% significant level.

ملخص

تبحث هذه الدراسة في العوامل المحددة للاستثمار الأجنبي المباشر في بعض البلدان في الأسواق الناشئة. وأبرز سمة مميزة لهذا البحث التجريبي عن أقرانه هي أنه يشتمل على مؤشر الحرية الاقتصادية (EFI) ومؤشر إدراك وجود الفساد (CPI) باعتبارهما المتغير التفسيري في النموذج. وبعد اختبارات التبعية الشاملة لعدة قطاعات والاختبارات الجذرية للوحدات، قُدرت المتغيرات الطويلة والقصيرة الأجل حسب نموذج الانحدار الذاتي للإبطاء الموزع (ARDL). واستُخدمت الطريقة التجريبية في مجموعة البيانات خلال الفترة 1997-2018 لتحديد أثر مؤشر الحرية الاقتصادية ومؤشر إدراك وجود الفساد على الاستثمار الأجنبي المباشر في أسواق ناشئة مختارة. وتظهر النتائج التجريبية أن

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العلاقة بين مؤشر إدراك وجود الفساد والاستثمار الأجنبي المباشر هي علاقة إيجابية. كما تبين أن تأثير هذا المؤشر كبير جدا بين المتغيرات الطويلة الأجل، كما تؤدي الزيادة في المستوى الكبير بنسبة 1% إلى زيادة الاستثمار الأجنبي المباشر في المستوى الكبير بنسبة 7%.

ABSTRAITE

Cette étude examine les déterminants des investissements directs étrangers dans certains pays des marchés émergents. Le trait le plus distinctif qui distingue cette recherche empirique de ses pairs est qu'elle inclut les scores EFI (indice de liberté économique) et CPI (indice de perception de la corruption) comme variable explicative dans le modèle. Après les tests de dépendance en coupe et les tests de racine unitaire, les paramètres à long et court terme ont été estimés par le modèle ARDL. La méthode empirique a été employée sur les données de la période 1997-2018 pour déterminer l'impact de l'indice de liberté économique et de l'indice de perception de la corruption sur les investissements directs étrangers dans certains marchés émergents. Les résultats empiriques montrent que la relation entre l'indice de perception de la corruption et l'investissement direct étranger est positive, l'effet de l'IPC s'est avéré être significatif parmi les paramètres à long terme, et une augmentation de 1% du niveau significatif augmente l'IDE de 7% du niveau significatif.

Keywords: FDI, Economic Freedom, CPI, PANEL ARDL

1. JEL Classification: C13, E22, F21, E02Introduction

Nowadays, interest in promotion activities made to attract foreign direct investments and increase the attraction in the emerging markets is surging. Economists/experts agree on the importance of foreign direct investment because investment acts as a cornerstone by acting as a trigger for the increase of national income, economic growth and sustainable development. Although globalization slows down (pandemic effect, quotas, additional tax, commerce wars), FDI shows a positive change and countries are making efforts to attract such investments. Reason; It is the elimination of the savings gap of these countries with foreign capital, contributing to capital accumulation, and the introduction of new technology and management knowledge into the country. Increasing competition in the country will improve human resources and eliminate the deficits in the balance of payments by creating employment. As a result of all these effects, the development rate of the country will increase and it will have a positive effect on economic growth (Alfaro, Chanda, Kalemli-Ozcan, and Sayek, 2004; Hansen & Rand, 2006). However, how

and in which direction FDI will affect which of the economic variables may vary (see Table I). For this reason, it may not meet all expectations. The economic impacts of FDI vary from country to country and from sector to sector (Kok and Acikgoz Ersoy, 2009; Sánchez-Martín, de Arce, and Escribano, 2014).

Table I: FDI Inflows and Projections, By Group Of Economies And Region, 2017–2019, And Forecast 2020 (Billions Of Dollars And Per Cent)

Group of economies/region	2017	2018	2019	Projections
				2020
World	1 700	1 495	1 540	920 to 1 080
Developed economies	950	761	800	480 to 600
Europe	570	364	429	240 to 300
North America	304	297	297	190 to 240
Developing economies	701	699	685	380 to 480
Africa	42	51	45	25 to 35
Asia	502	499	474	260 to 330
Latin America and the Caribbean	156	149	164	70 to 100
Transition economies	50	35	55	30 to 40
Memorandum: annual growth rate (per cent)				
World	-14	-12	3	(-40 to -30)
Developed economies	-25	-20	5	(-40 to -25)
Europe	-16	-36	18	(-45 to -30)
North America	-40	-2	0	(-35 to -20)
Developing economies	7	0	-2	(-45 to -30)
Africa	-10	22	-10	(-40 to -25)
Asia	7	-1	-5	(-45 to -30)
Latin America and the Caribbean	14	-5	10	(-55 to -40)
Transition economies	-25	-51	59	(-45 to -30)

Source: UNCTAD, FOMNE database (www.unctad.org/tdistatistics).

Note: Projections are based on UNCTAD's forecasting model (box I.1) and expert judgement. Numbers are rounded.

Firms want to examine every variable while making investment decisions. Therefore, the characteristics of the market/country to be invested are evaluated. Its legal structure, political structure, social-cultural structure, and economic indicators are discussed in detail. There are many determinants in the literature that affect FDI.

In this paper, we examine whether economies with certain countries in emerging markets are able to benefit more from EFI (Economic Freedom Index) and CPI (Corruption Perception Index) to promote their FDI.

2. EFI and CPI, Certain Countries in Emerging Markets

Economic freedom is measured by the Heritage Foundation's Economic Freedom Index (EFI) and is defined as "the absence of government coercion or constraint on the production, distribution, or consumption of goods and services beyond the extent necessary for citizens to protect and maintain liberty (Yap and Sufian, 2018). The creators of the Economic Freedom index have embraced an approach similar to that of Adam Smith (The Wealth of Nations), according to which the basic institutions that protect the freedom of individuals to pursue their own economic interests create greater prosperity for society at large (Nica, 2020). To measure economic freedom with 50 independent economic variables, these some variables; business freedom, trade freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, and labor freedom (Peterson and Hoque, 2013). Corruption activities in a country; change according to many different factors that emerge depending on the economic, social, political, and cultural structure of the country and causes the social structure to deteriorate gradually. It is possible to determine whether the corruption activities of countries are at a low or high level, in other words, to measure corruption with the corruption index (Buz and Dayioglu, 2018). Corruption Perception Index is prepared by Transparency International, headquartered in Berlin. This index is based on the public sector of the countries and they are ranked according to the level of corruption by means of this index. The score for any country ranges from "0" highly corrupt to "100" very clean. The rank of the country refers to its position in comparison to other countries. *"CPI is a compound index that is formed using the researches of businessmen and country analysts. It includes reliable resources that use several sampling frames and different methodologies"* (Uca, Ince, and Sumen, 2016). Some countries have worked diligently to fight corruption and at times find themselves shifting in the index. Other countries seem to be doing little or nothing and yet they move several positive positions upward. Correspondingly, foreign direct investment increases or decreases (Gilman, 2018).

Economic freedom and corruption are always significant issues that governments should control, due to their effects on the development of each country is very large, especially in developing countries. The results indicate that the index of economic freedom and corruption perceptions were strongly and positively correlated with the degree of importance of corporate income tax revenue at 1 percent. Moreover, at a 10 percent degree of importance, the annual inflation rate has a negative and important effect on corporate income tax revenue (Cung, 2019). The average value of all data for the years 2000-2004 in 38 developed countries was used by Demirhan and Masca (2008). The empirical findings in the main model showed that the effect on FDIs of per capita growth rate, main telephone lines and degree of transparency is positive and important, whereas inflation and tax rates have a negative and significant impact on FDI. The article also found that the relationship between labor costs and FDI has a positive and negligible effect.

The accumulated long-run impact of corruption on growth is that when the reversed CPI increased by one standard deviation, real per capita GDP declined by about 17 percent. The effects of corruption on economic growth are particularly pronounced in autocracies and are transmitted to growth through a decrease in FDI and a rise in inflation. (Gründler, K., and Potrafke, 2019) In the article, to determine the impact of corruption perceptions index and economic freedom index on FDI (net inflows) for the years 1999-2018 in Vietnam. The results show that the index of economic freedom has a positive impact and significant (at a 5%) while the index of corruption perceptions has a significant positive impact (at a 1%). Therefore, the article expresses should continue improving these two factors (EFI&CPI) in an upward direction in order to partly enhance national competitiveness in attracting FDI. (Cung and Nhung, 2020). Using panel data analysis, Azman-Saini, Baharumshah, and Law (2010) examine economic independence, foreign direct investment, and growth relationships in 85 countries. The findings indicate that foreign direct investment has no direct (positive) effect on economic development. However, because of the degree of economic freedom in the host countries, FDI is important. In other words, countries that promote economic independence reap the benefits of FDI. Using data from 1995 to 2014, Sahin (2018) investigates the relationship between direct foreign capital investments, economic freedoms, and economic development in BRICS-T countries. Kloya's bootstrap panel causality analysis is used by

ahin (2006). In Turkey, a causal relationship between economic freedom and foreign direct investment has been observed.

There are no generally accepted concrete indicators regarding the assessment and determination of rising powers. Naturally, this situation makes such conceptualization and categorization difficult. For this reason, a socio-economic comparison is made for the selected countries in the paper in Table II.

Table II: A Socio-Economic Comparison Is Made for The Selected Countries

Countries	Population	Growth (%)	GDP(million,\$)	S&P	MSCI	IMF
Mexico	128.933.000	-8,9	1.258.286	+	+	+
Philippines	108.928.000	-8,3	376.796	+	+	+
Vietnam	97.380.000	1,6	261.291	-	-	-
S.Africa	59.671.000	-8	351.432	+	+	+
Turkey	84.174.000	6.7	754.412	+	+	+

Source : Ministry of Trade, Turkey, 2019

3. Econometric Analysis

In this part of the study, the definition of the data used in the study, the cross-section dependency tests in question, the stability tests of the variables, the cointegration tests, the long and short term analysis with the panel ARDL, as well as all the empirical results will be evaluated. The reason why Panel ARDL is preferred as an empirical method is to determine the effects of the variables in the study on foreign direct investments and detailed results can be determined by comparative analysis of the countries found. In addition, with the ARDL application, it is aimed to determine the short and long-term relationships between foreign direct investments and these variables.

3.1. Dataset

In this study, the variables cover the period between 1997 and 2018, and econometric analysis will be carried out with annual data. The data of the study were obtained from the official websites of three institutions, World Bank, Transparency International and Heritage Foundation.

The data in the study are dollar-based and the index values to be included in the models range from 0-100. In the table below, the sources and descriptive statistics of the data are specified by explaining the dependent and independent variables to be used in this study.

Table III. Dataset

Variables	Descriptive statistics	Source
FDI	Foreign Direct Investment	World Bank
EXC	Exc. Rate Of Dollar (USD/ Local Currency)	World Bank
CPI	Corruption Perception Index	Transparency International
EFI	Economic Freedom Index	Heritage Foundation

FDI ve EXC logarithmically transformed and descriptive statistics are given in the table.

Table IV. Descriptive statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
lfdi	overall	22.37464	1.230873	20.01399	24.57911	N = 110
	between		0.942903	21.53027	23.91727	n = 5
	within		0.8929	20.34528	23.89554	T = 22
cpi	overall	35.31091	7.847343	23	52	N = 110
	between		7.485411	28.02273	46.15	n = 5
	within		4.042827	26.80182	45.80182	T = 22
efi	overall	59.17	6.658423	38.6	68.3	N = 110
	between		6.359189	48.32273	64.12727	n = 5
	within		3.418533	49.44727	64.99727	T = 22
lexc	overall	3.694266	3.275493	-1.88476	10.0258	N = 110
	between		3.616956	0.287906	9.755574	n = 5
	within		0.408586	1.521597	4.980869	T = 22

3.2. The Model

Within the scope of this article, the author perform a model and the author as the most distinctive feature that distinguishes in this empirical research from its peers is that it used the EFI (Economic Freedom Index) and CPI (Corruption Perception Index) index the explanatory variable in the model. After cross-section dependency tests and unit root tests, long and short-term parameters were estimated by ARDL model.

Model FDI (Foreign Direct Investment) was created as follows by accepting that it is a function of EFI (Economic Freedom Index) and INF (Inflation), CPI (Corruption Perception Index), EXC (Exchange Rate).

$$FDI_{it} = f(EFI_{it}, CPI_{it}, EXC_{it})$$

Here, it expresses: FDI_{it} = the amount of foreign direct investment that country i received in period t, EFI_{it} = the economic freedom index value of country i in period t, CPI_{it} = the corruption perception index of country i in period t, EXC_{it} = dollar rate of country i in period t, $i=1,2,3,4,5$ (number of countries), $t=1,2,3, \dots, 22$ (time dimension).

3.3. Stationarity Analysis

When conducting econometric analysis, one of the most important issues to be considered in order to reach the correct result is that the series are stationary. If the mean and variance of the time series are constant over time and the covariance between two periods depends on the distance between the two periods, not the time of the observed variables, the time series is stationary. If the series is not stable, it cannot maintain its average in the long term and the variance value goes away as the time approaches infinity. Autocorrelation values move away from zero as the number of lags increases, R2 values are high and t statistics values are significant. Thus, the model estimates obtained in the long term cannot give accurate results and a false regression model emerges. In the study, it was first examined whether there is a cross-sectional dependency between variables. The existence of cross-section dependence also requires the application of tests that take into account the cross-section dependency in selecting the methods to be used in the following stages. If there is no cross-sectional dependency, first-generation unit root tests, otherwise,

second-generation unit root tests, which also take into account cross-sectional dependence, should be used.

Cross Section Dependency Test

In general, it is assumed that the error terms between the units in the panel data models are uncorrelated. This is especially true for panels with large horizontal cross-section dimensions. Since the study covers few units and relatively long period, cross-section dependency should be examined. The accuracy of the unit root tests to be performed later depends on the results obtained here. Although various tests are available, the Breusch-Pagan (1980) LM test was deemed suitable because it has a few cross-section units but a relatively long period.

Figure 1. Correlation matrix of residuals

```

      _e1  _e2  _e3  _e4  _e5
_e1  1.0000
_e2  0.3760 1.0000
_e3  0.3223 0.2506 1.0000
_e4  0.1121 0.2717 0.1536 1.0000
_e5  0.2390 0.6986 0.5377 0.2064 1.0000

Breusch-Pagan LM test of independence: chi2(10) = 28.487, Pr = 0.0015
Based on 22 complete observations over panel units

```

Since the null hypothesis expressing cross section independence is rejected, second generation unit root tests should be used.

CIPS unit root test

CIPS statistics are calculated by taking the average of the unit root test statistics of each cross section (CADF).

Table V. CIPS Results

CIPS test	Const.	Const.+Trend	Unit root
	Prob	Prob	
LFDI	0.348	0.606	+
D.FDI	0.004	0.041	-
LEFI	0.755	0.987	+
D.LEFI	0.01	0.02	-
LCPI	0.894	0.637	+
D.LCPI	0.090	0.000	-

3.4. Cointegration Process

After testing whether the series contain unit root or not, it was seen that the series were stationary at I (1) level, and whether there was a long-term mutual relationship was investigated by Pedroni (1999) and Kao (1999) panel cointegration tests. The appropriate lag lengths that overcome the autocorrelation problem were determined with the Schwarz information criterion.

Table VI. Pedroni Test

	Statistic		Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	1.217283	0.1117	1.064874	0.1435
Panel rho-Statistic	-0.765122	0.2221	-0.453547	0.3251
Panel PP-Statistic	-2.273254	0.0115	-2.101232	0.0178
Panel ADF-Statistic	-2.237115	0.0126	-2.154283	0.0156

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	0.379976	0.6480
Group PP-Statistic	-2.387698	0.0085
Group ADF-Statistic	-2.133796	0.0164

Kao Test		<i>H0: There is no cointegration.</i>	
	ADF	t-Statistic	Prob.
		-2.995377	0.0014
Residual variance		0.470408	
HAC variance		0.213100	

Of the seven test statistics calculated for the Pedroni test, four reject the null hypothesis. However, since the Kao test statistics also rejected the null hypothesis, we conclude that the series are co-integrated.

3.5. The Model Estimation

The panel ARDL (p, q, q..., q) model can be expressed as follows.

$$\Delta Y_{it} = \theta_i [Y_{i,t-1} - \lambda'_i X_{i,t}] + \sum_{j=1}^{p-1} \xi_{ij} \Delta Y_{i,t-j} + \sum_{j=0}^{q-1} \beta'_{ij} \Delta X_{i,t-j} + \varphi_i + e_{it}$$

It expresses here:

θ_i : Adjustment coefficient

λ'_i : Long-term relationship vector

$[Y_{i,t-1} - \lambda'_i X_{i,t}]$: Error correction term

$\xi_{i,j}, \beta'_{ij}$: Short-term relationship coefficients

After determining the optimal lag length according to Eviewste AIC criteria, the ARDL (2,1,1,1) model was estimated by PMG and MG estimators and the results are given in the table.

Table VII. ARDL Results

N=5 , T=21		ARDL(2,1,1,1)		PMG results		MG results	
<i>Long Term</i>	Coefficient	Std error	t-stat.	Prob.	Coefficient	Std error	Prob.
LEFI	0.661	0.860	0.768	0.445	-12.8536	10.2065	0.2080
LEXC	1.691	0.235	7.183	0.000	3.8165	3.7620	0.3100
LCPI	2.886	0.670	4.305	0.000	7.2995	3.6439	0.0450
<i>Short Term</i>							
ECM	-0.624	0.206	-3.023	0.003	-0.6632	0.1968	0.0010
Δ LEFI(-1)	0.073	0.176	0.413	0.680	-0.0362	0.1615	0.8220
Δ LEFI	-2.850	5.334	-0.534	0.595	-4.6573	5.2190	0.3720
Δ LEXC	-0.894244	0.832534	-1.074124	0.2861	0.4487	0.2833	0.1130
Δ LCPI	-0.310618	0.897196	-0.346209	0.7301	1.9424	1.0388	0.0610
C	3.076401	1.919269	1.602903	0.1131	22.7934	13.4828	0.0910

Pesaran et al. (1999) created two estimators: Mean Group (MG) and Pooled Mean Group (PMG), both of which can be used. When MG is unable to distribute those parameters uniformly across cross-section units, PMG is used to perform the necessary estimation. The PMG estimator, which incorporates pooling and averaging, allows intercepts, short-run coefficients, and error variances to vary freely between classes while constraining long-run coefficients to be the same (Pesaran et al., 1999). The PMG estimator appears to be suitable for the considered function due to initial conditions or systemic variables that have the potential to affect all classes in a similar way. In cross-country studies, the probability ratio used to measure homogeneity of error variances and/or short- or long-run slope coefficients typically rejects equality of error variances or slopes at traditional significance stages, according to Pesaran et al. (1999). Due to this problem, Pesaran et al. (1999) recommend using Hausman (1978)-type tests. Although the PMG and MG estimators are expected to be consistent under long-run slope homogeneity, only the PMG estimator is assumed to be effective.

Figure II. The Hausmann Test

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) mg	(B) pmg		
lefi L1.	-12.85364	.6606058	-13.51424	12.71587
lexc L1.	3.816495	1.691143	2.125351	4.691688
lcpi L1.	7.299533	2.8859	4.413634	4.500466

b = consistent under Ho and Ha; obtained from xtmg
 B = inconsistent under Ha, efficient under Ho; obtained from xtmg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
 = 13.94
 Prob>chi2 = 0.0030

Before interpreting the results, it was concluded that the MG estimator was effective and consistent because the Chi square tail probability was greater than 0.05 in the Hausman test, which was conducted to decide which was the effective and consistent predictor.

Table VIII. MG results

<i>Long Term</i>	Coefficient	Std error	t-stat.	Prob.
EFI	-12.8536	10.2065	-1.2600	0.2080
LEXC	3.8165	3.7620	1.0100	0.3100
LCPI	7.2995	3.6439	2.0000	0.0450
<i>Short Term</i>				
ECM	-0.6632	0.1968	-3.3700	0.0010
Δ LFDI(-1)	-0.0362	0.1615	-0.2200	0.8220
Δ LEFI	-4.6573	5.2190	-0.8900	0.3720
Δ LEXC	0.4487	0.2833	1.5800	0.1130
Δ LCPI	1.9424	1.0388	1.8700	0.0610
C	22.7934	13.4828	1.6900	0.0910

When the short-term parameters were analyzed, only the error correction term was found to be statistically significant and negative. In other words, when our variables with long-term equilibrium relationship deviate from balance with a shock, they return to equilibrium level after about 2 periods. The empirical results show that the relationship between corruption perceptions index and foreign direct investment is a positive, The effect of CPI was found to be significant among the long-term parameters, and an increase of 1% significant level increases FDI by 7% significant level.

4. Conclusion

In this study is examined the freedom index and corruption index scores as explanatory variables. If some indicators are good in the freedom index and the corruption index, it will attract FDI to the country. If there is a setback, the investor runs away. Overall, it is difficult to determine a priori whether the CPI or EFI the mitigation effects will dominate the relationships between FDI inflows variables of other selected emerging

markets. For the purposes of this paper, and given the chosen approach and data limitations, when short-term parameters were analyzed, only the error correction term was found to be statistically significant and negative. In other words, when our variables with a long-term balance relationship deviate from balance by a shock, they return to the balance level after about 2 periods. Since FDI's rapid response to independent variables is theoretically not expected, the short-term coefficients are insignificant, satisfying the expectation. In addition, only CPI was found to be significant among the long-term parameters, and an increase of 1% increases FDI by 7%.

In order to prevent corruption, countries should attach importance to creating a corporate culture. In corporate culture, using effective and efficient corporate communication, creating common values, and employees' feeling of corporate belonging will contribute to the country. Nonetheless, it would be worthwhile to further explore and test the EFI&CPI of other countries foundations of FDI inflows under uncertainty in future research.

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