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Role of Oil Prices in Financial Instability, Trade Openness and Economic Growth: Evidence from ASEAN Countries

(*Peranan Harga Minyak dalam Ketidakstabilan Kewangan, Keterbukaan Perdagangan dan Pertumbuhan Ekonomi: Bukti dari Negara ASEAN*)

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ABSTRACT

This paper examined the interaction effect of oil prices on financial instability, trade openness, and economic growth in leading ASEAN countries. Based on the data over 1970-2019, this research used the second-generation panel approach to examine the effects of this study. The results of the cross-sectional dependency (CD) test, and the slope homogeneity test showed that the slope heterogeneity exists among countries and the relationship between cross-sectional units. The findings of the co-integration have showed that financial instability, trade openness, oil prices and economic growth have a stable and long-run linkages. In addition, the findings have shown that economic growth is adversely impacted by financial instability and oil prices, and that trade openness has a positive effect on economic growth. The findings further demonstrated the negative effects on economic growth of the interaction term with oil prices and financial instability. The interaction term for oil prices and openness in trade, however, has a positive effect on leading ASEAN economies' economic growth. Nevertheless, the findings of the causal test showed a one-way causal association between financial instability and economic growth; oil prices and economic growth. Similarly, the results confirmed the bidirectional causality between trade openness and economic growth.

Keywords: ASEAN; economic growth; financial instability; oil prices; trade openness

ABSTRAK

Kertas ini mengkaji kesan interaksi harga minyak terhadap ketidakstabilan kewangan, kebebasan perdagangan, dan pertumbuhan ekonomi di negara-negara ASEAN utama. Berdasarkan data dari tahun 1970 hingga 2019, penyelidikan ini menggunakan pendekatan panel generasi kedua untuk mengkaji kesan kajian ini. Hasil ujian ketergantungan keratan rentas (cross-sectional dependency, CD) dan ujian kecerunan homogeniti menunjukkan bahawa terdapat ketidaksamaan cerun di antara negara-negara dan hubungan antara unit-unit keratin rentas. Hasil ko-integrasi menunjukkan bahawa ketidakstabilan kewangan, kebebasan perdagangan, harga minyak, dan pertumbuhan ekonomi mempunyai hubungan yang stabil dan jangka panjang. Selain itu, hasil kajian menunjukkan bahawa pertumbuhan ekonomi terjejas secara negatif oleh ketidakstabilan kewangan dan harga minyak, manakala kebebasan perdagangan mempunyai kesan positif terhadap pertumbuhan ekonomi. Hasil kajian juga menunjukkan kesan negatif terhadap pertumbuhan ekonomi dari istilah interaksi antara harga minyak dan

ketidakstabilan kewangan. Walau bagaimanapun, interaksi bagi harga minyak dan kebebasan dalam perdagangan mempunyai kesan positif terhadap pertumbuhan ekonomi negara-negara ASEAN utama. Namun demikian, hasil ujian kausaliti menunjukkan hubungan satu hala antara ketidakstabilan kewangan dan pertumbuhan ekonomi; harga minyak dan pertumbuhan ekonomi. Begitu juga, hasil kajian mengesahkan kausalit9 dua hala antara kebebasan perdagangan dan pertumbuhan ekonomi.

Kata kunci: ASEAN; pertumbuhan ekonomi; ketidakstabilan kewangan; harga minyak; keterbukaan perdagangan

JEL: B41, B43, K32, C01, C01

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INTRODUCTION

For the running of an economy through mobilization and use of capital, the financial sector plays a critical role and helps smooth business and resource monitoring. For the efficient distribution of funds, a sound financial system is extremely important and makes economic operations more profitable, thus leading to better growth (Ibrahim & Acquah 2021). An established financial infrastructure offers dramatically increased access to financial services and decreases business costs. A stable financial structure increases the potential for investment by conveniently obtaining financial services and lending at low interest rates, supplying production sector funding and promoting business (Hassan et al. 2016; Jakada et al. 2020; Nasreen et al. 2020; Cheng et al. 2021; Muhammad Dabachi 2021). The financial system also boosts investment prospects. Schumpeter (1911) was the first person to understand the effects on economic growth of financial operations and emphasizes the importance of the financial system to economic progress. Many other experiments have subsequently shown that an advanced financial structure tends to enhance economic growth (Aluko & Ibrahim 2020; Acquah & Ibrahim 2020; Jakada et al. 2020; Adam et al. 2021; Junior et al. 2021). Each sector of the economy also plays a key role in fostering economic development, and no exception is the financial sector.

Trade openness, particularly in the developed and emerging markets, has become one of the recent developments that drive their own economic growth. There have been repeated discussions in literature on the appropriateness of trade transparency for economic development. In a variety of analytical studies available, the effects of trade transparency are discussed. Some reports indicate that trade openness has a significant positive influence on economic development (Silajdzic & Mehic 2018; Keho 2017; Kong et al. 2021). Others say that the free trade to economic growth results are limited but optimistic (Su et al. 2019; Çevik Atukeren & Korkmaz 2019). The great achievement of ASEAN economies further supports the argument that trade openness is useful for economic growth, even if these economies have other determinants of economic growth (Khobai et al. 2018; Alkhawaldeh et al. 2020; Saleem & Shabbir 2020).

Moreover, recent tremendous shifts in trade volume to China indicate that trade-friendly economies have a more productive impact than those producing for domestic demand only without economies of dimension. Arrow (1962) says that foreign exchange should create more R&D and that learning can be essential in order to boost competitiveness and thus economic growth. In addition, trade openness, advancement in technologies and human resources still play a critical role in economic development (Hdom & Fuinhas 2020; Raghutla 2020; Gabriel & David 2021). This paper started with the observation that while openness to trade is known to be a determinant of economic development, its effects vary considerably between economies and it depends on economic absorption and sound economic policies. The energy sector is a strong contributor to income of the energy sector by exporting nations.

The oil price will decide oil income dramatically. Due to unregulated oil demand, the rising operations are a sign of higher incomes in the petroleum exporting economies and declining operations will hurt any petroleum exporter's growth method. The classification of oil prices is also important for oil-exporting economies, as much of their revenue depends on the output of petroleum, price and revenue of oil to sustain income levels. In the oil-exporting world, growing operations are also good news. Increasing oil prices will then improve investment and other economic activities in the oil-exporting, thus increasing economic growth. Rising prices of oil prices sparked interest in studying the relationship between fluctional oil prices and economic development among politicians, practitioners and academics in the world. It has also contributed to improvements in the field of economics, enabling researchers to theoretically and empirically investigate the practical correlation between oil price and macroeconomic variables (Munir et al. 2020; Zalina Zainal et al. 2021; Ebi & Aladejare 2022).

Theoretically, the impact of petroleum prices can be seen in a couple of channels on economic growth. Firstly, rising oil prices will contribute to wealth transfer from oil importers to oil exporters. This growth in wealth will lead to an increase in demand and then to economic growth (Wali et al. 2020). Secondly, the price of oil would rise because oil is an industrial raw material (Hakimah et al. 2019; Rosnawintang et al. 2020; Pramahesti & Hartono 2020). That will contribute to higher costs of finished products. Inflation can be caused by the constantly increasing cost of commodities. When the inflation rate is higher

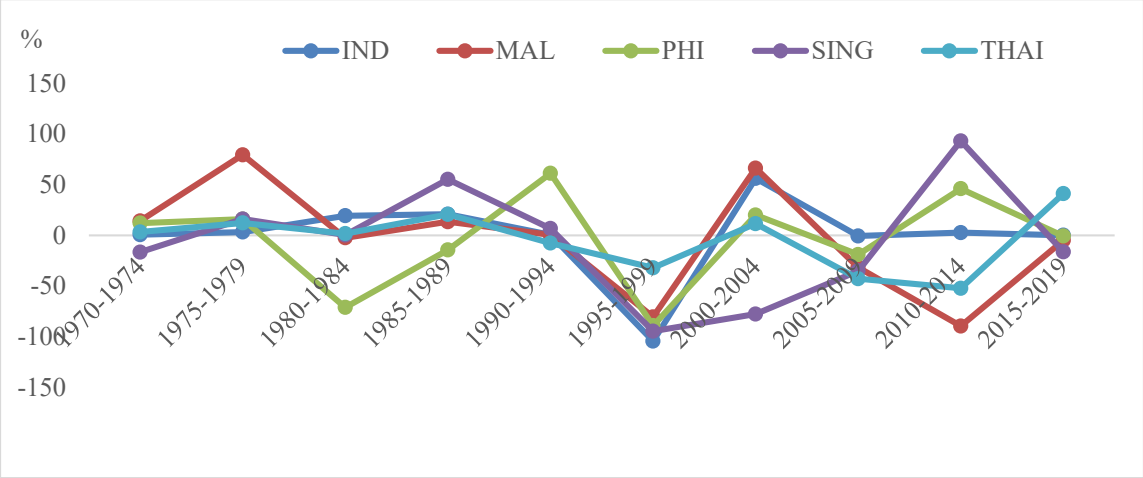
than the inflation forecasts of a country's government (the Central Bank), the Central Bank, by increasing its domestic interest rates, can suppress inflation by monetary policy (Fitriyanto & Iskandar 2019; Kriskkumar & Naseem 2019; Nathaniel et al. 2021; Jafri et al. 2021). Such higher interest rates will then limit domestic investments, thus reducing economic growth in turn. The structural situation of the economy (e.g. imbalance of supply and demand), and the bullish surprise of financial sector investors where oil is a key commodity of derivatives markets, are the cause of high volatility in oil prices.

Conversely, oil price fluctuations have two effects on oil-importing countries. Firstly, a decline in oil benefits oil-importing countries since their balance of payments and terms of trade improve. Second, an increase in oil prices may result in a significant reduction in revenue, particularly for nations whose economy are heavily reliant on oil (Akinsola et al. 2020). The demand and supply-side impacts were both emphasised in the theoretical explanation of the link between oil price and economic growth. Again from demand side, a drop in oil prices raises an oil-importing country's disposable income, increasing demand for other commodities, particularly those with high income elasticity. Reduced oil prices, on the other hand, have an influence on other energy goods like coal, gas, and electricity. Oil is a production input for numerous commodities, including power and transportation, on the supply side. An increase in oil prices will result in higher production costs and pricing for other goods. As a result, oil price fluctuations may have an impact on the pricing of other commodities, and therefore play an important part in the link between economic growth and oil prices. (Samawi et al. 2017; Odhiambo 2020; Prabheesh et al. 2020; Kalymbetova et al. 2021; Lin & Bai 2021).

However, oil shocks or oil shocks may result in rising or declining oil prices. The strong increase in petroleum prices, in 2007-2008, was caused by high demand in ASEAN countries for petroleum (Munir et al. 2020; Prabheesh & Laila 2020). This strong demand is due to the fact that oil plays an important role for manufacturing, transport and electricity in the global economy (Islam & Ghani 2018; Kisswani 2019; Nawaz et al. 2019). Meanwhile, oil prices decreased in 2008 as a result of falling global demand for oil due to the current economic crisis (Youssef & Mokni 2019). Researchers find that a rise in oil production and speculative demand on the futures market is the primary cause of the strong volatility in oil prices. Such a high volatility in oil prices can lead to economic instability, leading to delays in investment and reduced economic growth.

Nevertheless, most Asian countries have seen a very high domestic gross product over the last decades. The annual average growth rates between 1970 and 2019 were larger and higher than the global average. Most of the emerging ASEAN economies have seen their real domestic growth product (RGDP) expand even further, but very few countries have achieved a high income in the whole country, although most still have to cope with income trapping (Ahmad et al. 2018). Obviously, these emerging ASEAN-led higher-income economies have seen a positive pattern with average global economic growth and average developing countries. Conversely, while some ASEAN countries experienced positive and higher real economic growth, the country experienced tumultuous times of downward trend in economic growth in 1970-2019 (see figure 1).

FIGURE 1. Leading ASEAN Real Gross Domestic Product (RGDP) from 1970-2019 (Source: WDI 2021)



On the other hand, the emphasis was on the money market with little respect to capital market practices in developing economy countries such as ASEAN countries. In addition, in the last twenty years, the ASEAN countries have experienced severe attacks of financial instability. Banking crises have become so familiar that it is the erratic country that has not experienced one although complete financial crises have struck some economies with overwhelming effects. Financial instability, although a predominantly severe problem for emerging market countries such as ASEAN which suffer extremely when it happens, has struck industrialized countries just as frequently. If the financial system does not perform this role efficiently, then the economy

cannot function well, and economic growth will be severely hampered. The main reason why many developing countries remain poor is that their financial sectors remain underdeveloped (HO et al. 2021).

However, the rising share of ASEAN countries in the world, trade underscores this point. The Intra-ASEAN trade grew at an annual rate of 22 percent over the period 1990-1996, getting approximately $127 billion in 1995, compared to 15 percent for the world overall. This activity remains heavily concentrated in three ASEAN economies, with Malaysia, Thailand and Singapore accounting for almost 90 percent of intra-ASEAN trade in 1995. Despite the significant increase in trade between ASEAN members, intra-ASEAN trade remains a small part of total ASEAN trade, accounting for around 19.6 percent in 1995. If transhipment of ASEAN sourced goods through Singapore discounted, the intra-ASEAN share of total ASEAN trade could be as low as 12 percent. But in the previous year, Intra-trade among the ASEAN countries is around 52 percent (HO et al. 2021; Nguyen & Bui 2021).

Furthermore, none of the previous studies studied compare the economies of the leading ASEAN countries. This study therefore analysed three key factors, namely financial instability, oil prices and trade openness in the leading ASEAN countries' domestic product, in particular. In order to devise better policies to achieve greater growth in gross domestic product per population, it is important to analysed and measure the effects of different factors on economic growth in these countries to increase the quality of life for people in ASEAN countries. Therefore, this study examined the interaction term of oil prices on financial instability, trade openness, and economic growth in leading ASEAN countries. Consequently, this study made three contributions. Firstly, this study examined the interaction term of oil prices on the effect of financial instability and trade openness on economic growth from 1970-2019. Secondly, this study employed second-generation dynamic panel techniques of analysis that are considered to be more powerful and less bias, in order to achieve the study objective. Most of the previous studies failed to reach a consensus on the direction of causation between financial instability, oil prices, trade openness and economic growth is because the neglect of dependence across the countries in a panel by using first generation panel unit root and cointegration tests. The first-generation panel tests are characterised by the assumption of independent cross-section members. Thus, they argued that the conclusions of many empirical studies may be based on deceptive inference since the assumption of independent panel members is not valid (Ahmad et al. 2018, Atiku et al. 2021). Recently, only a few so-called second-generation panel tests have been proposed that take into account the existence of cross-sectional dependency relations (Atiku et al. 2022). Therefore, the innovative contribution of this study is the application of second-generation panel unit root test and panel cointegration test that ruminates both structural breaks and cross-sectional dependence to provide more precise and reliable results.

This study used two-unit root tests: Cross sectional Im, Pesaran and Shin (CIPS) and Cross-sectional Augmented Dickey-Fuller (CADF) to determine the stationarity of the variables. Also, the study used Rees and Westerlund cointegration test to evaluate the long run link among the variables. Furthermore, the study used DCCE and CS-ARDL techniques developed by Chudik and Pesaran (2015) to estimate our model. This method is considered to be robust to various forms of errors in cross sectional dependency, non-homogeneous slope and any possible non-stationarity in the variables. Moreover, this work conducted causality test developed by (Dumitrescu & Hurlin 2012). Finally, this study pertains to the ASEAN-5 group, which are ASEAN's top countries but have received little attention. The ASEAN-5 countries were chosen because they have flourishing commercial activity and strong rates of economic growth. These countries have commonalities and connections in a variety of sectors, particularly economics, as evidenced by the formation of the ASEAN Economic Community (AEC) on May 12, 2015. The paper is organized as follows. The following section discusses the brief of literature review. The next section methodology and empirical strategies. The fourth section estimation results, and the final section concludes.

LITERATURE REVIEW

This section gives a detailed overview of current research studies that identify economic growth determinants. Many studies have analysed the link between financial instability, trade openness, price of oil and economic growth.

EFFECT OF FINANCIAL INSTABILITY ON ECONOMIC GROWTH

Ouyang and Li (2018) examined the impact of financial development and power use on the Chinese economy with data from the 30 provinces of China from 1996Q1 to 2015Q4, using the GMM panel VAR tool. The results revealed that the use of energy has a positive and important effects on the economic development in China, without any reverse effect in the western region alone. Furthermore, the Granger causality test justified this finding. M2 thus has negative implications in terms of energy demand in all three areas for private industry, market capitalisation and a financial growth index. In areas in the eastern region where bidirectional causality was found in central regions the causality from energy consumption was not important due to financial development and causation in the western region, the Granger causality test showed that heterogeneity is observed between consumption and financial development. The activities of Ridzuan et al. (2018) were comparing, using data from 1985 to 2010,

to assess the inflation growth nexus and the nexus to fund growth both in the short and the longer term. The paper used the ARDL approach of examining these two links in the Malaysian economy. They applied Autoregressive Distributive Lag approach. Their study verified the presence of inflationary nexus in the economy of Malaysia which, in contrast to financial development, has been seen to be a greater contribution to economic growth. Also, other control variables were found to be positive and significant.

Also, Swamy and Dharani (2018) investigated the causality between economic growth and financial growth in 24 developed financially growing countries, using 1983-2013 evidence. The findings indicated the long-term negative and important linear links between financial development and progress. The two-way correlation between financial progress and economic growth has been created. The analysis used inflation, interest rate and demographic moderation to replace the balance of finance with expansion in the economy of Malaysia. In addition, the coefficient of trade openness was positive and important, complimenting Malaysia's nexus of financial development. This will make a big contribution to the link between financial and growth in the Malaysian economy by promoting trade opening. In addition, Huchet et al. (2018) work stimulated the discussion on financial development links, taking into consideration the factor of economic inclusion of international trade in calculating open-ended trade. The two additional factors were consistency of the commodity and diversification. The findings showed that economies with high quality goods and trading in diversified products are growing more than others. The result also showed that there is a non-linear ratio of dependence on trade for countries with single or lower quality goods.

Moreover et al. (2018) compared the long and short run relationships between variables between 1990 and 2014 in 12 countries of the European Union, examined the impact of renewable energies consumption on economic growth. The research used the Vector Correctors (VECM) and Granger causality checks for a complex panel. The consequence of the Granger causality test panel indicates that the causalities vary in the short-term from renewable energies to economic development. Safi et al. (2021) examined how financial uncertainty affects consumption-based CO2 emissions. Their study used second- and third-generation panel cointegration methods. Cross-sectional dependence and slope heterogeneity demonstrated that panels are connected and slope heterogeneity exists. The short- to long-term studies show that demand, financial instability, imports, exports, technical innovation, and economic progress affect carbon emissions. Financial volatility, technical development, and exports reduce carbon emissions, whereas imports and economic expansion raise them. CCEMG and Amplified Middle Group Robustness Tests verify results (AMG).

Similarly, the impact of financial sector creation on economic growth of 25 sub-Saharan African countries for 2010–2017 have been examined by Taddese and Abebaw (2021). In particular, the GMM two-step framework estimate estimated three dynamic Panel data models which consider the impact of the depth, access and efficiency of the financial sector on economic growth. The loan extended to the private sector, by economic growth, the commercial banking arm, and Return to assets is used as a depth, access and productivity proxy, respectively for the financial sector. The findings thus showed the strong and statistically important impact on the economic development of these countries in terms of depth, access and productivity in the financial sector. They then advocated that it be necessary for the organizations involved to increase the depth of financial institutions by crediting the private sector. Furthermore, it would be necessary to extend the financial institutions to increase their mass accessibility and to take certain steps to promote their performance.

EFFECT OF TRADE OPENNESS ON ECONOMIC GROWTH

The long-term correlation between trade openness and economic growth between Nigeria and Ghana from 1980 to 2016 was explored by Khobai et al. (2018). They applied ARDL model, and findings showed that there is a long-term relationship between Nigeria and Ghana. Furthermore, the results showed that openness to trade has a positive and substantial impact on economic development in Nigeria as well as a negative and negative effect. For the major ASEAN nations, HO et al. (2021) investigated the causal link between financial development and economic growth through trade openness (Indonesia, the Philippines, Malaysia, Singapore, Thailand, and Vietnam). Their study used Random Effect Method and Granger causality test. Their results revealed that trade openness has a positive relationship with growth whereas financial development has a positive but negligible relationship with growth. The rationale for this is that financial development and economic expansion are perhaps linked. The causality test is then used to further investigate and corroborate the findings. That is, financial development and economic growth are found to have bidirectional beneficial links through trade openness. This suggested that disregarding the presence of trade openness, which has a favourable influence on the connection between finance and growth, would result in flaws.

Likewise, Qasim et al. (2021) empirically explored whether Institutional Quality (IQ) and Trade Openness (TO) are rivals or complements in Economic Growth (EG) in the sample South Asian economies of "India, Bangladesh, Pakistan, and Sri Lanka." The panel data for the years 1984 to 2018 were used. For the empirical research, the Fixed Effects Model (FEM) estimate approach was used. The FEM empirical results indicated that IQ and Interaction Term have a positive and statistically significant influence on economic growth in the sample nations. In the instance of sample SAE, the positive significant results significantly supported the study's premise that IQ and TO are complements in EG. The IQ test has a favourable and substantial influence on

EG, but the TO has a negative effect. This paper proposes that policymakers in sample nations implement policies that increase the IQ in order to boost trade and, as a result, the EG, based on empirical data.

Furthermore, in a multivariate framework, Rahman (2021) investigated the dynamic connection of energy consumption, international commerce, and foreign direct investment (FDI) with economic growth for a panel of BRICS and ASEAN nations from 1990 to 2017. For empirical research, the panel co-integration test, panel quantile regression technique, impulse response function, and heterogeneous panel causality test are employed. The findings indicated that the variables have a long-run equilibrium connection. The impacts of energy consumption, foreign commerce, capital, and FDI on the economic growth of these nations are determined to be favourable and substantial in the long run. The findings of the heterogeneous panel causality test show that energy consumption and economic growth, labour force and economic growth, international trade and energy consumption, and labour force and international trade are all bidirectionally related. There is also a unidirectional causation between economic growth and international trade and FDI, as well as between international trade and energy use and FDI.

Additionally, the interaction effect of trade openness and institutional quality on economic growth in Sub-Saharan Africa is investigated by Akinlo and Okunlola (2021). The sample includes 38 nations in Sub-Saharan Africa and spans the years 1986 to 2015. Estimation approaches included pooled OLS, fixed effect, and Dynamic GMM. In the empirical part, a nonlinear growth regression specification was used to examine the relationship between trade openness, law and order, bureaucratic quality, corruption, government stability, and democratic accountability. The study discovered that as institutional quality factors, corruption, government stability, law and order, and bureaucratic quality all harmed economic growth. Economic growth was boosted by the interplay between trade openness and institutional quality factors. It suggests that in the presence of high-quality institutional factors, trade openness has a greater influence on economic growth.

Lastly, over the period 1990–2018, Banday et al. (2021) explored the causal link between foreign direct investment, trade openness, and gross domestic product in BRICS nations. To evaluate cointegration, they used an auto regressive distributed lag model and the Dumitrescu and Hurlin Granger causality tests. FDI and trade openness have a beneficial influence on long-term economic growth, according to empirical findings. We also discovered that the real effective exchange rate and gross capital creation have a long-run connection with economic growth. The primary findings of the causality study show that there is bidirectional causation between foreign direct investment and economic growth, as well as unidirectional causality between trade openness and foreign direct investment.

EFFECT OF OIL PRICES ON ECONOMIC GROWTH

Dabachi et al. (2020) explored the causal relation between environmental pollution, electricity use, energy price intensity and OPEC economic growth from 1970 to 2018. Their results suggested that the variables have long-lasting relationships. In addition, the test findings of causality have shown a two-way causal link between energy use and growth of GDP; and the relationship between environmental pollution and economic growth, oil prices and economic growth. The unidirectional causal link lies between economic growth and energy intensity, and between energy consumption and energy intensity. Further analysis has shown that there is a bi-directional causal correlation between oil prices and energy levels, between deterioration of the atmosphere and energy intensity, and between depletion of the environment and oil prices of all nations.

Also, the oil prices of the seven low-incoming sub-Saharan Africa (SSA) countries (Ethiopia, Gambia, Mali, Mozambique, Senegal, Tanzania and Uganda) analysed the effect of oil prices upon development in Akinsola and Odhiambo. (2020) In addition, they investigated the short- and long-term effect of the price of petroleum using Panel-Auto Regressive Distributive Lag (Panel-ARDL). The findings suggested that the oil price has no substantial short-term effect on the group's economic development, but a major negative influence on the long term. The short-term country coefficients however indicate that in all seven countries the price of oil has a major but mixed effect on economic development. In the same vein, they explored the asymmetric effect of the oil price on economic development using the Non-linear Autoregressive Distributed Lag (NARDL) model by breaking up oil prices into negative and positive shifts. The benefit of this model is that it explores both the asymmetrical long-term and short-term impacts on inflation of the actual oil price. They found that a decline in oil prices had a favorable and essential impact on productivity, while a rise in oil prices had a detrimental effect. Furthermore, for both the PMG and the five short-term country coefficients, error correction terms are negatively and statistically relevant. For this purpose, it would be necessary for policymakers to research and enforce successful energy policies in order to reduce oil pricing risks, especially in the long term, through technological advances.

Similarly, Mahmood and Murshed (2021) stated the substantial contribution of oil prices (OP) and revenue to oil producers' profits. The main source of Saudi revenue is petroleum. The effect of OP on revenue is therefore very critical. In particular, it is important to test asymmetry in order to determine whether or not expanded activity has the same effects on revenues. The current research uses non-linear cointegration techniques to resolve this problem. They also observed the symmetrical effect of OP on long-term and short-term asymmetric results. In comparison, rising and degrading income impacts are both fun and detrimental.

In addition, rising OPs have a better impact on short-term income than declining OP. In the presence of foreign trade, technical development and economic growth in emerging seven (E-7) countries from 1995 to 2018.

The research mentioned above, in general, emphasize the impact of oil prices, trade openness, and financial instability on economic growth. However, there is limited evidence that oil prices, trade openness, and financial instability have a direct effect economic growth in ASEAN countries. This study aims to add to the empirical literature on the effect of oil prices, trade openness, and financial instability on economic growth. For at least two reasons, we believe our contribution is significant. Firstly, this paper addresses a lack of studies conducted on ASEAN member countries by assessing the interaction effect of oil prices on trade openness, financial instability, and economic growth from 1970–2019. Secondly, the present study differs from previous studies by using the DCCE and CS-ARDL techniques to estimate our model to investigate interaction term of oil prices on trade openness, and financial instability on economic growth.

METHODOLOGY

THEORETICAL FRAMEWORK AND DATA

This section offered a spontaneous theoretical context that canvasses the effects on economic growth from financial instability, trade openness, oil prices and oil price interaction terms. This research advanced the theoretical/conceptual construct by using Cobb–comprehensive Douglas's production framework from Umar et al. (2015), Kamalu et al. (2019), Ahmad et al. (2020), Dabachi, et al. (2020), Kamalu et al. (2022). The production framework is described as:

$$Q_{it} = W_{it}K_t^{\aleph}\aleph > 0$$

Furthermore, Ahmad, et al., (2018), embodied financial instability, trade openness and oil prices to evaluate the influence of this variable on economic growth. Hence:

$$Q_{it} = \left(W_0\sigma^{fi}fi_{it}^{\rho}top_{it}^{\vartheta}top_{it}^{\delta}(op \times top)_{it}^{\gamma}(op \times fi)_{it}^{\theta}\right)K_{ti}^{\aleph} \qquad (1)$$

where W_0 represents the initial stock of knowledge, fi represents financial instability, top means trade openness, op indicates oil prices, $op \times top$ stands for interaction term of oil prices and trade openness, and symbolizes $op \times fi$ stands for interaction term of oil prices and financial instability, t is time. Turning equation (2) and (3) into a linear form, we have:

$$lnRGDP_{it} = \omega_{it} + \rho lnFI_{it} + \vartheta lnTOP_{it} + \theta lnOP_{it} + \varepsilon_{it} \qquad (2)$$

$$lnRGDP_{it} = \omega_{it} + \rho lnFI_{it} + \vartheta lnTOP_{it} + \theta lnOP_{it} + \delta\ln(OP \times TOP)_{it} + \gamma ln(OP \times FI)_{it} + \varepsilon_{it} \qquad (3)$$

In Eq. (2) and (3), i denotes the ith country in the panel; t represents time; ω_{it} symbolizes the constant; $\rho, \vartheta, \theta, \delta, and\ \gamma$ respectively denote the elasticity coefficients of financial instability (lnFI), trade openness (lnTOP), oil prices (lnOP), interaction term of oil prices and trade openness (lnOP × TOP), interaction term of oil prices and financial instability (lnOP × FI); ε_{it} indicates the error term. This used economic growth for five leading ASEAN countries (Indonesia, Thailand, Malaysia, Singapore and Philippines) using dynamic panel data techniques of analysis from 1970 to 2019. These data are obtained from the world development indicators database of world bank (World Bank 2021). The financial instability (FI) was measured by composite index comprises of total domestic credit, domestic credit to private sector, stock market capitalisation, broad money (M2) and bank lending rate. Another explanatory variable in the growth equation is the oil prices (OP) measured by the ration of crude oil price and consumer price index (Baumeister & Peersman 2013; Ahmad et al. 2018). The trade openness (TOP) proxy by summing total export and import of goods and services in monetary terms (US Dollars) as the percentage of GDP. However, this study used 5 countries panel study following the works of Tuna and Tuna (2019), Guzel and Okumus (2020), Yilanci and Pata (2020), Batool et al. (2021), Rosnawintang et al. (2021), Tan and Uprasen (2021)

In addition, this study generated the financial instability following the work of Dabachi et al. (2021). This has been done by using residuals absolute value required by regressing the indicators of financial development that is domestic credit by bank, domestic credit by private sector, lending rate, and broad money supply on their lagged value with trend. The financial instability measure is presented in the following equations:

The standard financial development deviation is: $U_I^{FD} = \sqrt{\sum_{t=1}^{n} \frac{1}{n-1} (K_{it}^{FD} - FD^{FD})^2}$ (4)

The residuals absolute value is: $U_I^{FD} = \frac{1}{n} \sum_{t=1}^{n} |\sigma_t|$ (5)

σ_t is attained by assessing the following equation

$$x_{it} = \vartheta + \pi_1 x_{i,t-1} + \pi_2 t + \varepsilon_t \quad (6)$$

It can be improved conferring to interest of the current study as follow:

$$FD_{it} = \vartheta + \pi_1 FD_{i,t-1} + \pi_2 t + \varepsilon_t \quad (7)$$

The latter approach is more advanced than the second to calculate financial instability. A stochastic or deterministic trend in time does not presume that the first method. Thus, the second approach for generating the financial instability index is employed. Moreover, this study used interaction term between oil prices and trade openness; oil prices and financial instability to moderate their joint influence on economic growth in five leading ASEAN countries by following Jaccard et al. (2003). Thus, the auxiliary regression of the products of two variables will be estimated against each variable separately. The interaction equation will be specified as follows:

$$lnFI_{it} \times lnOP_{it} + lnTOP_{it} \times lnOP_{it} = \delta_1 + \gamma_1 lnFI_{it} + \gamma_2 lnTOP_{it} + \gamma_3 lnOP_{it} + U_{it} \quad (8)$$

Thus, the interaction term is resulting by assessing the regression and creates its residual.

TABLE 1. Description of the variables

Acronym	Unit	
$LNRGDP$	$\frac{GDP\ (current\ US\$)}{Consumer\ Price\ Index} \times 100$	Ahmad, et al., 2018; Dabachi, et al., 2020
$LNFI$	Residuals absolute value required by regressing the indicators of financial development	Dabachi, et al., 2021
$LNOP$	Ration of crude oil price and consumer price index	Baumeister, & Peersman, 2013; Ahmad, et al., 2018
$LNTOP$	summing total export and import of goods and services in monetary terms (US Dollars) as the percentage of GDP	Ahmad, et al., 2018

Source: (Authors)

ECONOMETRIC METHODOLOGY

In working with panel data, close analysis must be taken of the potential effect on error terms and variables of certain "unobserved common processes" (or "factors"). This is called cross-sectional dependency (CD). CD can occur from shocks (strongly or weakly) of unpredictable common factors that affect all panel units and all panel units (Chudik et al. 2011). As far as computing tools are concerned, this research utilized econometric techniques of the second generation in order to avoid skewed and inaccurate estimations if the panel were heterogeneous and cross-sectional. Six measures are used as an assessment technique. Firstly, the cross-sectional dependency (CD) test was carried out (Pesaran 2004). Secondly, the research has applied the Pesaran and Yamagata slope homogeneity test (2008). Thirdly, the second-generation panel unit root testing of Pesaran, like CADF and CIPS, has been carried out in the sample following the detection of cross-sectional dependency. This research used the second generational co-integration test developed by Westerlund to determine the long-term relationship of the variables (2007). This research used Chudiks and Pesarans (2015) to test longer run performance elasticity in the cross-sectional autoregressive distributor lags (CS-ARDL). The (Chudik & Pesaran 2015) proposed Dynamic Command Correlated Estimator (DCCE) was used to verify the robustness. The causal relationship among the variables were investigated by Dumitrescu and Hurlin (2012).

CROSS-SECTIONAL DEPENDENCE TEST

Cross-sectional dependency (CPD) is one of the main concerns before evaluating panel data models, since it would be essential to choose suitable econometric techniques. Breusch and Pagan (1980) recommended the LM test in panel data in order to analyze the CD in the panel's panel data for the zero hypothesis with no cross-sectional dependency. However, for panels with broad cross-sectional units the LM Test may not be sufficient. Pesaran (2015) built the CD test on the following statistics in order to correct this drawback:

$$CD = \sqrt{\frac{2T}{\tau(\tau-1}}\sum_{i=1}^{\tau-1}\sum_{j=i+1}^{\tau}\frac{(T-m)\breve{\aleph}_{ij}^2 - E\left[\left((T-m)\breve{\aleph}_{ij}^2\right)\right]}{var\left[\left((T-m)\breve{\aleph}_{ij}^2\right)\right]} \quad (9)$$

Where $\breve{\aleph}_{ij}^2$ is the similarity between the residues derived from the OLS estimate of each pair. In comparison, the CD measure suits the panel with a small transverse axis, a small-time dimension and a broad cross-sectional dimension with a small-time dimension.

TESTING SLOPE HOMOGENEITY

On the other hand, the validity of the non-constancy of slope homogeneity in the coefficients among cross-sections instigates the importance of slope heterogeneity (Eberhardt & Teal 2012; Gunduz 2017). For this reason, we employ the slope homogeneity test by Pesaran and Yamagata (2008). This test extends the Swamy (1970) test called the $\tilde{\Delta}$ test. While the former is applied to panels with relatively large/small cross-section (N) to the time dimension (T), the latter is applied to a cross-section that is relatively small to the time dimension. The modified version of Swamy's statistics is extended to both balanced and unbalanced data. The standardised statistics for unbalanced data is given by:

$$\bar{\theta} = \sum_{i=1}^{\tau}(\breve{\rho}_i - \bar{\rho}_{WFE})'\frac{G_i' J_t G_i}{\breve{\vartheta}^2{}_i}(\breve{\rho}_i - \bar{\rho}_{WFE}) \quad (10)$$

In Eq. (10), $\bar{\rho}_{WFE}$ represents the pooled slope coefficient weighted effect, while $\breve{\rho}_i$ is the pooled OLS regression cofactor per unit. Besides, $\breve{\vartheta}^2$ signified the evaluation of $\breve{\vartheta}^2{}_i$, and J_t specified the uniqueness matrix. Furthermore, the consistent dispersion statistic Δ and the biased-adjusted dispersion $\overline{\nabla}_{adj}$ are stated as:

$$\overline{\nabla} = \sqrt{\tau}\left(\frac{\tau^{-1}\bar{\theta} - m}{\sqrt{2m}}\right) \quad (11)$$

$$\overline{\nabla}_{adj} = \sqrt{\tau}\left(\frac{\tau^{-1}\bar{\theta} - Y(\bar{p}_{it})}{\sqrt{var(\bar{p}_{it})}}\right) \quad (12)$$

Where $Y(\bar{p}_{it}) = m$ and $var(\bar{p}_{it}) = \frac{2m(T-m-1)}{T+1}$

PANEL UNIT ROOT TEST

The stationary measurements of the variables were carried out in Two "generations" of the panel unit root tests. The techniques of first generation presume that panel data units are cross-sectionalized while second generation allows the panel units to be cross-sectionally dependent. With regard to the root testing of the second-generation panel unit, with the zero-hypothesis of non-stationarity Pesaran (2010) has created the CADF and CIPS test. Eq. (13) provides the statistics of the CADF:

$$\Delta L_{i,t} = \pi_i + \omega_i L_{i,t-1} + \gamma_i \bar{L}_{t-1} + \delta_i \Delta\bar{L}_{i,t} + \varepsilon_{it} \quad (13)$$

Likewise, Pesaran (2007) stated the CIPS statistic as:

$$\bar{L}_{t-1} = \frac{1}{\tau}\sum_{i=1}^{\tau} L_{i,t-1}\,;\; \Delta\bar{L}_{i,t} = \frac{1}{\tau}\sum_{i=1}^{\tau} L_{i,t-1}\,\Delta L_{i,t} \tag{14}$$

$$CIPS(\tau,T) = \frac{1}{\tau}\sum_{i=1}^{\tau}(\tau,T)\,t_i \tag{15}$$

Where
$(\tau,T)\ t_i$ indicates the t statistic of ω_i

COINTEGRATION TEST

This research uses Westerlund (2007) co-integration experiments to analyze the long-term association between these variables. Due to its applicability to the model, the Westerlund co-integration test has slope heterogeneity. In addition, the test deals with cross-sectional dependence. The test of Westerlund uses four statistics of the test, two of which are group statistics (signified by Gt and Ga). The panel co-integration test outlined in the following error correction equation was established by Westerlund (2007).

$$\Delta L_{i,t} = \partial_i'\pi_t + \alpha_i\left(R_{i,t-1} - \gamma_i' L_{i,t-1}\right) + \sum_{j=1}^{m}\delta_{ij}\Delta R_{i,t-j} + \sum_{j=0}^{m}\beta_{ij}\Delta L_{i,t-j} + \varepsilon_{i,t} \tag{16}$$

Where α_i is the error correction coefficient for each individual. Westerlund (2007) suggested two sets of statistics including two groups of average statistics and two committees to inspect the null hypothesis (no cointegration between variables).

The statistics of Gτ and Gα are used to verify if cointegration occurs in at least one cross-sectional unit and are calculated as:

$$G_\tau = \frac{1}{\tau}\sum_{i=1}^{\tau}\frac{\breve{\alpha_\iota}}{Se(\breve{\alpha_\iota})} \tag{17}$$

$$G_\alpha = \frac{1}{\tau}\sum_{i=1}^{\tau}\frac{T\breve{\alpha_\iota}}{1-\sum_{j=1}^{m}\widehat{\alpha_{\iota j}}} \tag{18}$$

Statistics for Pτ and Pα are used to determine if the whole panel has co-integration and are given in Eqs. (17) and (18):

$$P_\tau = \frac{\breve{\alpha}}{Se(\breve{\alpha})} \tag{19}$$

$$P_\alpha = T\breve{\alpha} \tag{20}$$

CROSS-SECTION AUGMENTED AUTOREGRESSIVE DISTRIBUTED LAGS (CS-ARDL)

This research was conducted using the methodology CS-ARDL to explore the effects of financial instability, trade openness, oil prices, interaction terms of oil prices and openness to trade, the interaction of oil prices and financial instability on economic growth. This approach is more effective and it has more power since it tackles slope heterogeneity, endogeneity issues, and cross-sectional dependency (Jakada et al. 2023). In addition, in the event of limited samples, the procedure gives correct results. Since the variables not found have an explanatory influence that could yield inaccurate and responsive estimates, CS-ARDL is a powerful approach to resolve this problem. This research used the CS-ARDL approach on the basis of its clear presumptions. The equation of CS ARDL is specified as:

$$\Delta RGDP_{i,t} = \sigma_i + \sum_{j=1}^{q}\forall_{it}\Delta GDP_{i,t-1} + \sum_{j=0}^{q}\forall_{it}'\Delta L_{i,t-1} + \sum_{j=0}^{q}\forall_{it}'\Delta\bar{P}_{i,t-1} + \varepsilon_{ij} \tag{21}$$

Where

$$\bar{P}_{i,t} = \left(\overline{GDP_{t,}}\Delta\bar{P}_t\right) and\ L_{it}(FI_{it}, TOP_{it}, OP_{it}, (OP \times FI)_{it}, (OP \times TOP)_{it} \quad (22)$$

and,

$$\bar{P}_{i,t} = \left(\overline{GDP_{t,}}\Delta\bar{P}_t\right) and\ L_{it}(FI_{it}, TOP_{it}, OP_{it}, (OP \times TOP)_{it}, (OP \times FI)_{it} \quad (23)$$

L is the set of explanatory variables such as FI, TOP, OP, $OP \times TOP$, $OP \times FI$

For robustness testing, Chudik and Pesaran (2015), using a dynamic heterogeneous panel data (DPHD) framework was developed the dynamic common correlated effect (DCCE) method. In particular, Pesaran's original approach (2006) assumes that there are exogenous variables that need input among observables that can cause serious coherence issues. In particular, the latest method from Chudik and Pesaran (2015) deals with three main challenges. The first is cross-sectional correlations, which are tackled with crosssectional averages and the reaction variable with the explaining variables on the right side of the model. The second problem is the heterogeneity of parameters that are overcome by an average group solution by Eberhardt and Presbitero (2015). The third issue is the dynamics that can be solved by assimilating lag dependent variable into the model. The DCCE estimation process addresses all the issues that have been addressed with more precise estimates for the DHPD model. Therefore, the appropriate DHPD model is:

$$lnRGDP_{i,t} = \sigma_i + \omega_i lnRGDP_{i,t-1} + \varphi lnFI_{i,t} + \delta lnTOP_{i,t} + \gamma lnOP_{i,t} + \sum_{j=1}^{2} \emptyset' R_{i,t} + \sum_{x=0}^{\rho} \tau_{1ix}\, \overline{lnRGDP_{t-x}} + \sum_{x=0}^{\rho} \tau_{2ix}\, \overline{lnFI_{t-x}} + \sum_{x=0}^{\rho} \tau_{3ix}\, \overline{lnTOP_{t-x}} + \sum_{x=0}^{\rho} \tau_{3ix}\, \overline{lnOP_{t-x}} + \sum_{x=0}^{\rho}\sum_{j=1}^{2} \partial'_{ix}\, \overline{R_{t-x}} + \varepsilon_{i,t} \quad (24)$$

$$lnRGDP_{i,t} = \sigma_i + \omega_i lnRGDP_{i,t-1} + \varphi lnFI_{i,t} + \delta lnTOP_{i,t} + \gamma lnOP_{i,t} + \mu \ln(OP \times TOP)_{i,t} + \pi \ln(OP \times FI)_{i,t} + \sum_{j=1}^{2} \emptyset' R_{i,t} + \sum_{x=0}^{\rho} \tau_{1ix}\, \overline{lnRGDP_{t-x}} + \sum_{x=0}^{\rho} \tau_{2ix}\, \overline{lnFI_{t-x}} + \sum_{x=0}^{\rho} \tau_{3ix}\, \overline{lnTOP_{t-x}} + \sum_{x=0}^{\rho} \tau_{3ix}\, \overline{lnOP_{t-x}} + \sum_{x=0}^{\rho} \tau_{4ix}\, \overline{ln(OP \times TOP)_{t-x}} + \sum_{x=0}^{\rho} \tau_{5ix}\, \overline{ln(OP \times FI)_{t-x}} + \sum_{x=0}^{\rho}\sum_{j=1}^{2} \partial'_{ix}\, \overline{R_{t-x}} + \varepsilon_{i,t} \quad (25)$$

PANEL CAUSALITY TESTS

The homogeneous noncausality test as a null hypothesis (HO) against heterogeneous noncause hypothesis (H1), introduced by Dumitrescu and Hurlin (2012) to be amended by the noncausality test Granger (1969). The H1 hypothesis allows for some but not all units, X to Granger trigger Y, which is seen as:

$$Y_{i,t} = \vartheta_i + \sum_{m=1}^{m} \pi_{im}\, Y_{i,t-k} + \sum_{m=1}^{m} \sigma_{im}\, L_{i,t-k} + \varepsilon_{i,t} \quad (26)$$

The null hypothesis is:

$$H_0: \sigma_{i1} = \cdots = \sigma_{im} = 0$$

The alternative hypothesis is:

$$H_1: \sigma_{i1} = \cdots = \sigma_{im} = 0, \mu_i = 1, \ldots\ldots N_1$$

$$H_0: \sigma_{i1} \neq 0 \; or \; \ldots\ldots or \sigma_{im} \neq 0 \; \mu_i = N_1 + 1, \ldots\ldots N$$

Where $0 \leq \frac{N_1}{N} \leq 1$

and then averaging the Wald statistics (Wi) for N units:

$$\bar{M} = \frac{1}{\tau}\sum_{i=1}^{\tau} M_i \tag{27}$$

The distribution of normal standard shown in Eq. (28)

$$\bar{S} = \sqrt{\frac{\tau}{2m}}(\bar{M} - m) \rightarrow \tau(0,1) \tag{28}$$

In addition, distribution of normal standard ˜S, accustomed for fixed T breadth are:

$$\tilde{S} = \sqrt{\frac{\tau}{2m} \times \frac{(T - 2m - 5)}{(T - m - 3)}} \times \left[\frac{(T - 2m - 3)}{(T - m - 1)}\bar{M} - m\right] \rightarrow \tau(0,1) \tag{29}$$

RESULTS AND DISCUSSION

DESCRIPTIVE STATISTICS

The findings of this study demonstrate that kurtosis and skewedness are asymmetry in their distribution, as presented in Table 2 for the chosen countries in this study (Ahmad et al. 2015a; Ahmad et al. 2015b; Ahmad et al. 2015c). In the light of the entire ASEAN sampled panel, the response to financial instability is averagely –2.330 and standard deviation is 1.277, based on variables of interest. In addition, the average trade openness is 4,625 and the standard deviation is 0.748. Similarly, with a standard deviation of 0.876 the oil price variable is on average -0.366. In averagely, the RGDP was 5.535, and the dispersion was 1.292. The reason why the average RGDP value is high is because of high wages, tax exemptions, devaluations, low government spend, and consequently low interest rates. The rationale is given for high RGDP demand. In the other hand, that may be attributed to a rise in full supply in terms of increased expenditure in terms of output. In general, there was a large heterogeneity and fascinating findings in the country groups in comparisons between the findings from descriptive statistical data (Ahmad et al. 2015d; Ahmad et al. 2015e; Ahmad et al. 2015f). In conclusion, the skewness and kurtosis results revealed that not all series of data meet normal distribution approximately. The research was further examined in the application of the DHPD paradigm for multicollinearity in explanatory variables.

TABLE 2. Descriptive statistics

	$LNRGDP_{it}$	$LNFI_{it}$	$LNTOP_{it}$	$LNOP_{it}$
Mean	5.535	-2.330	4.625	-0.366
Median	2.312	-2.099	4.484	-0.535
Maximum	6.483	0.109	6.080	2.566
Minimum	-2.084	-6.232	3.356	-1.764
Std. Dev.	1.292	1.277	0.748	0.867
Skewness	0.534	-1.306	0.462	1.268
Kurtosis	4.090	4.564	1.939	4.316

Source: (Eviws 10 Output)

CORRELATION ANALYSIS

The correlation matrix with the variance inflation factor and tolerance is used to check for multicollinearity with independent variables. The correlation values between independent variables are significantly smaller than 0.7 as illustrated in Table 3, while the VIF are far below 5 with a tolerance value smaller than 2. This thus suggests that multicollinearity is not existent among the variables used, so a variable can be called a linear combination of certain independent variables (Umar et al. 2015; Ibrahim et al. 2020).

TABLE 3. Correlation matrix

Variables	$LNGDP_{it}$	$LNFI_{it}$	$LNTOP_{it}$	$LNOP_{it}$	VIF	Tolerence
$LNGDP_{it}$	1.000					
$LNFI_{it}$	-0.541* [-10.156] (0.000)	1.000			1.52	0.658
$LNTOP_{it}$	-0.441* [-7.737] (0.000)	0.418* [7.265] (0.000)	1.000		1.48 1.82	0.675 0.550
$LNOP_{it}$	0.652* [13.552] (0.000)	-0.573 [-10.998] (0.000)	-0.557* [-10.566] (0.000)	1.000		

Source: (Eviws 10 Output)

CROSS-SECTIONAL DEPENDENCY RESULTS

This research first examined cross-sectional dependency in panel statistics, as it affects the robustness of later estimate findings in the event that econometric techniques of the second generation are not used. In other words, the analysis used second-generation econometric methods for consistent long-term projections in the occurrence of cross-sectional dependency (Jakada et al. 2022a; Jakada et al. 2022b). Breusch and Pagan (1980) test Lagrange Multiplier (LM) can be used to analyze cross-sectional dependency in tables. However, Pesaran (2004) claimed that if the cross-sectional dimension is high, the LM-test is not sufficient. The CD test was then proposed by Pesaran (2004 and 2015). This research has therefore applied a CD test in various countries (Pesaran 2004 and 2015). The findings revealed that panel cross-sectional dependency was observed in Table 4 at 1% level of significance.

TABLE 4. Cross-sectional dependence results

Variables	CD-test	P-Value	mean ρ	mean abs(ρ)
$LNRGDP_{it}$	16.165	0.000	0.72	0.21
$LNFI_{it}$	20.976	0.000	0.94	0.15
$LNTOP_{it}$	14.748	0.000	0.59	0.14
$LNOP_{it}$	13.21	0.000	0.66	0.35

Source: (STATA 16 Output)

SLOPE HOMOGENEITY RESULTS

The research was used to test the slope homogeneity hypothesis using Pesaran and Yamagata (2008). Table 5 below indicates that the null slope homogeneity hypothesis was dismissed at a significance level of 1%, suggesting that a slope heterogeneity existed. The proof of parameter heterogeneity and cross-sectional dependency suggested that in the analysis conventional approaches such as PP, IPS and LLC are not suitable because of cross-sectional dependency issues (Danmaraya et al. 2021; Jakada et al. 2022c; Jakada et al. 2022d).

TABLE 5. Slope heterogeneous test

Variables	Delta	P-Value	Adj	P-Value
$LNRGDP_{it}$	10.86	0.000	11.452	0.000
$LNFI_{it}$	20.746	0.000	21.869	0.000
$LNTOP_{it}$	16.583	0.000	17.480	0.000
$LNOP_{it}$	18.900	0.000	19.922	0.000

Source (STATA 16 Output)

PANEL UNIT ROOT RESULTS

In this research CADF and CIPS were used for Pesaran's new unit root tests by Pesaran (2007). Table 6 below revealed that all null hypotheses of unit roots vary in the first instance with regard to CIPS and CADF unit root testing. Thus, at the level and first difference the real GDP variable showed that RGDP is I. (0). The first difference was significant due to the variable financial instability, prices of oil and openness to trade are all I (1).

TABLE 6. Results panel unit root

Variables	CIPS		CADF		Order
	Level	First Difference	Level	First Difference	
$LNRGDP_{it}$	-4.737*	-	-3.538*	-	I(0)
$LNFI_{it}$	-	-5.177*	-	-4.796*	I(1)
$LNTOP_{it}$	-	-5.997*	-	-5.094*	I(1)
$LNOP_{it}$	-	-5.319*	-	-4.775*	I(1)

Source: (STATA 16 Output)

PANEL COINTEGRATION RESULT

This research avoided conventional measures of co-integration because the heterogeneity and cross-sectional dependency of the co-integration variables were not addressed. Instead, the analysis used a Westerlund (2007) cointegration procedure using error correction. Table 7 showed the results of the cointegration test. The findings showed that for all the four westerlund statistics (Gć, Gα, Pμ and Pα), the null hypothesis of co-integration was not rejected at constant as well as trend and constant. It demonstrated that all the variables are linked in the long run: real GDP, financial instability, oil prices and trade openness. The results of these research are confirmed by other studies in the literature, which also found the existence of a long-run relationship between the actual GDP, financial instability, oil prices and openness to trade.

TABLE 7. Westerlund ECM panel cointegration tests

Statistics	Value	Z-value	Robust P-Value
G_τ	-4.371	-5.071	0.000
G_α	-23.732	-4.058	0.000
P_τ	-10.464	-5.838	0.040
P_α	-25.248	-6.066	0.020

Source: (STATA 16 Output)

LONG RUN AND SHORT RUN ESTIMATES

This study employed the CS-ARDL approach to analyze the effects of financial instability, trade openness, oil prices, interaction terms of oil prices and openness to trade, oil prices and financial instability. The results of the CS-ARDL method are listed in Table 8. It is clear that in five leading ASEAN countries FI, TOP, EP, TOP*OP and FI*OP are main factors in influencing economic growth. Model I is our model with three independent variables estimated and Model II with two interaction variables estimated. The negatives on economic growth from financial instability suggested that productivity and economic growth would be affected adversely by a financial crisis or financial shock in the economy. Furthermore, the negative effect of financial instability may lead to a financial crisis that also affects the real economy. Batuo and Kupukile (2012) research in African countries is supporting this finding. The negative coefficient of energy price also tends to cause instability in macroeconomics variables, destabilised productivities, consumption, and investment expenditures, hence negatively affecting GDP growth. The negative sign of energy price conflict the findings of Lee and Chang (2005), Behbondi et al. (2013), Amri (2017), Bekhet et al. (2017) that reported that oil prices positively affect economic growth, as the higher oil prices improve export earnings. Moreover, the coefficient of trade openness indicated that trade liberalisation has impact on the leading ASEAN countries' growth prospects. The positive coefficient of trade openness was supported by the work of Faisal et al. (2017), Iyke (2017), and Keho (2017). The positive coefficient of trade openness is justified by the endogenous growth theory that argued that trade openness promotes economic growth. Besides, openness promotes efficient allocation of productive resource, promote technological development and increases total factor productivity. Nevertheless, in model II, this study moderated the impact of financial instability with oil prices $LN(FI \times OP)$ on economic growth; and the impact of trade openness with oil prices $LN(TOP \times OP)$ on the economic growth of leading ASEAN countries. When these interactions' outcomes are positive and significant, moderating the effect of financial instability with oil prices and trade openness with oil prices are complimentary. When it is negative and significant, the effect is substituted. The complimentary effect means that the impacts of financial instability on economic growth continue to rise with rising oil prices. Similarly, the effect of trade openness on economic also rises with an increase in oil prices in leading ASEAN countries. Thus, the reverse will be the case when the effect of interaction is a substitute. The result indicated that the interaction term trade openness oil prices were positively related to the economic growth in the long-run and short-run, respectively, in the emerging ASEAN economies. This positive sign showed that the effect of trade openness on economic growth increases with oil prices. Furthermore, the interaction term financial instability oil prices were negatively related to economic growth. This negative sign showed that the effect of financial instability on economic growth decreases with oil prices. This indicated that moderating the effect of financial instability with energy is substitute. Nonetheless, the interaction term between trade openness and oil prices is substitute. Furthermore, the error correction term is negative and significant, which

showed that any deviation from the long-run path can be corrected, with the speed of adjustment at 59% and 61% per year respectively.

TABLE 8. CS-ARDL panel data estimation results

Dependent variable: $LNRGDP_{it}$						
	Model I				Model II	
Variables	Coefficients	Standard error	*p*-value	Coefficients	Standard error	*p*-value
	Long-run estimates				*Long-run estimates*	
$LNFI_{it}$	-0.882* [-3.675]	0.240	0.000	-0.467* [-6.671]	0.070	0.000
$LNOP_{it}$	-0.283* [-4.717]	0.060	0.000	-0.344 [-3.780]	0.091	0.000
$LNTOP_{it}$	0.308* [4.464]	0.069	0.000	0.324* [-6.894]	0.047	0.000
$LN\ (OP\times TOP)_{it}$				0.498* [6.304]	0.079	0.000
$LN\ (OP\times FI)_{it}$				-0.229** [-5.452]	0.042	0.031
	Short-run estimates				*Short-run estimates*	
$\Delta LNFI_{it}$	- 0.172* [-5.548]	0.031	0.000	-0.370* [-9.250]	0.040	0.000
$\Delta LNOP_{it}$	-0.385* [-14.259]	0.027	0.000	-0.736 [-0.770]	0.955	0.441
$\Delta LNTOP_{it}$	0.477* [8.518]	0.056	0.000	0.542* [8.885]	0.061	0.000
$\Delta LN\ (OP\times TOP)_{it}$				0.487* [6.088]	0.080	0.000
$\Delta LN\ (OP\times FI)_{it}$				0.254* [5.292]	0.048	0.000
ect_{t-1}	-0.593* [-5.402]	0.109	0.000	-0.612* [-5.546]	0.113	0.000

The DCCE framework was used to validate that the CS-ARDL approach was robust. It is clear that DCCE and CS-ARDL methods exhibit very close indicators of long-term evaluations. But the magnitudes are a bit different. Compared to the DCCE coefficient the value of the CS-ARDL process is higher. The outcomes of the DCCE method showed that financial instability, open trade, oil prices, interaction term of oil prices and trade openness, oil prices and financial instability are key factors in ASEAN countries' economic growth. Table 9 explains the findings on the basis of the DCCE estimator. In particular, the lagged economic growth value (L.lnRGDP) recorded – 0.651 signifies a corrected by 65% of annual economic growth in the ASEAN economy as a whole. The approximate DHPD model showed a positive signal of robustness for the panel in general. This is due to the statistical importance of the F-Test first for the panel, which means that the results will well match the model. Additionally, the R2 values for the panel are high, suggesting large variables in the dependent variable (economic growth). The predicted panel model's RMSE values are, finally, below 0.08 (Hair et al. 2017) and imply strong predictive ability for the model to predict the dependent variable

TABLE 9. DCCE robustness results

Dependent variable: $LNRGDP_{it}$						
	Model I				Model II	
Variables	Coefficients	Standard error	*p*-value	Coefficients	Standard error	*p*-value
	Long-run estimates				*Long-run estimates*	
$LNRGDP_{it}$	-0.651* [-6.446]	0.101	0.000	-0.441* [-4.594]	0.096	0.000
$LNFI_{it}$	-0.357** [-2.380]	0.150	0.031	-0.259* [-14.389]	0.018	0.000
$LNOP_{it}$	0.194** [2.587]	0.075	0.028	0.270** [3.068]	0.088	0.030
$LNTOP_{it}$	0.112* [10.181]	0.011	0.000	0.131** [2.729]	0.048	0.039
$LN\ (OP\times TOP)_{it}$	-	-	-	-0.350* [-5.224]	0.067	0.000
$LN\ (OP\times FI)_{it}$	-	-	-	-0.194** [-3.464]	0.056	0.031
F-stat	2.39*		0.000	2.89		0.000
R^2	0.59			0.74		
ROOT MSE	0.045			0.039		

CAUSALITY TEST RESULTS

The research proposed by Dumitrescu (2012) and Hurlin (2012) has shown that the causalities range unidirectionally from financial instability (LNFI) to economic growth (LNGDP) and from oil prices (LNOP) to economic growth. The findings also showed a bidirectional causal association between trade openness (LNTOP) and economic growth. There exists no reverse causality between financial instability and economic growth, and oil prices and economic growth. The causality from financial instability to economic growth suggested that in time of a financial crisis or financial shocks investment practices will decrease, which would have detrimental consequences on economic growth. Furthermore, the causal correlation between oil prices and economic growth can be caused by increased energy revenue earnings which will raise national income, and thereby economic growth. The bidirectional causality of openness to trade and growth may result from increased competitiveness, technology transfer and capital inflows that have a positive effect on productivity and foster growth and development.

TABLE 10. Granger Causality results

	$LNFI -/\rightarrow LNGDP$	$LNFI \leftarrow/- LNGDP$
W^{Hnc}	1.9362	10.891*
Z_{NT}^{Hnc}	1.4802	15.639
$\tilde{Z}_N^{HNC}$		
	$LNOP -/\rightarrow LNGDP$	$LNOP \leftarrow/- LNGDP$
W^{Hnc}	8.339*	2.543
Z_{NT}^{Hnc}	11.536	2.439
$\tilde{Z}_N^{HNC}$		
	$LNTOP -/\rightarrow LNGDP$	$LNTOP \leftarrow/- LNGDP$
W^{Hnc}	5.348*	7.427*
Z_{NT}^{Hnc}	4.551	10.162
$\tilde{Z}_N^{HNC}$		

CONCLUSION AND IMPLICATIONS

This study analyzed the impact on leading development in the ASEAN countries of financial instability, oil prices and trade openness. The research carried out several econometric methods and our models were estimated using CS-ARDL methods. The results have shown that financial instability and oil prices adversely affect growth, and trade openness in our sample in ASEAN countries facilitates economic growth. It was optimistic and complimentary to see the relationship of financial instability with

oil prices. In the other hand, there was a negative relationship between openness to trade and oil prices. The result is also a substitution. The following findings were drawn from the report. First of all, the study found that financial instability, oil prices, trade openness and economic growth in ASEAN countries are a long-running link. Secondly the CS-ARDL outcome also supported the co-integration test, which revealed a negative and significant influence by financial uncertainty and oil prices. Trade openness has also been seen to have an important positive impact on the ASEAN countries' economic growth. Thirdly, the negative coefficient of financial instability's relationship with oil prices confirmed the value of oil prices as stabilizers of macroeconomic variables. In addition, the positive of trade openness-energy price interactions have showed that in ASEAN countries trade restrictions and oil prices displaced each other.

ASEAN countries urgently need to consider a coordinated policy agenda on financial instability, prices of energy and openness to trade. They have a long-term effect on their economies' economic growth. Open rules must be seen as a source of financial instability and may adversely impact capital formations, financial intermediation and financial development. In order to control energy usage and stabilize oil prices in ASEAN countries, the comprehensive energy policy needs to be devised, as energy could adversely affect its economies, as most ASEAN leading states did not depend on oil revenue. Additionally, there is a danger that in trying to avoid financial instability. The intervention by emerging ASEAN countries policymakers can create rigidity or financial repression policies rather than realise a more stable financial system which could achieve by financial rules and regulations being designed to widen the space for the growth and stability of oriented macroeconomic policies. At the same time, it should be kept in mind that regulations can also be problematic not only because they can themselves be the source of instability and can have adverse effects on financial intermediation and development. These aspects of regulation should be taken into account when designing prudential and capital account regimes. It should take into account the fastidiousness of each country; no one-size-fits-all solution should be adopted. Institutions may need to be strengthened or created before new policies, and regulatory measures are introduced. To look into the situation, there should be coordination among the various public authorities responsible for monetary policy, regulation and monitoring of the financial system. Some of these responsibilities may come under the same authority; this applies in particular to the monetary policy. Financial management and supervision should come under the authority of the Central Bank, given their task of attaining stability in the financial system.

Moreover, the ASEAN government’s efforts should be direct in creating an economic environment which establishes a stable macroeconomic environment with sound monetary policies and fiscal discipline and a peaceful political climate. They should also provide adequate institutions that respect property rights, and law and order and generate sufficient human capital which can create a relationship between macro stability and economic growth that reduces uncertainty strengthens credibility and improves the overall macroeconomic environment. Thus, boosting foreign direct investment, domestic investment, and accelerating the process of economic growth and thereby reducing poverty. Government funds ought to be utilized just to secure the wellbeing and functioning of the financial system. When a banking issue emerges, the authorities ought to first evaluate whether the institution is enduring liquidity or a solvency issue and what the systemic ramifications of failure would be. Individual banks confronting solvency issues should receive support when their failure would debilitate overall financial stability either directly or because, in the judgment of the authorities, their failure would demoralise market certainty. Public funds should be provided transparently and to minimising moral hazard.

Also, it would be helpful for help to be given in ways that permit the public sector to benefit if asset prices recuperate. Monetary authorities should recognise banking system susceptibilities. For this, they should first distinguish the banks that are most likely to experience troubles in the present environment. Banking supervision should likewise demand high-recurrence information to continually evaluate bank liquidity and solvency and conduct credit hazard diagnostics and stress testing. Supervision ought to be as thorough as could reasonably be expected, covering foreign currency hazard, bank risk management practices, lending guidelines, and subsidizing dependability. It should stretch out to all deposit-taking and credit-creating institutions, including nonbank financial institutions. Procedures for taking care of a systemic crisis or failures inside all the financial services markets should be drawn up quickly in an arrangement for possibilities. The regions should track current G20 activities to reinforce control of cross-border financial flows and re-establish investor confidence to unfreeze global credit markets and inspire capital inflows and intraregional lending. Moreover, the interaction term of oil prices, have considerable consequences on their economic growth. These consequences are expected to be different in oil exporting and oil importing countries. Whereas an oil prices increase should be considered good news in oil exporting countries and bad news in oil importing countries, the reverse should be expected when the oil prices decreases.

The transmission mechanisms through which oil prices have an impact on economic growth include both demand and supply channels. The supply side effects are correlated to the fact that crude oil is an essential input to production, and consequently, an increase in oil prices leads to a rise in production costs that induces firms to lower output. Oil prices change also entail demand-side effects on consumption and investment. Consequently, there is no study without limitation. The following areas suggested for further studies: The endogenous growth models suggest that finance influences economic growth through some channels particularly through saving, investment, and productivity. In this study, we examine the financial instability and economic growth using two channels (oil prices and trade openness) for the case of leading ASEAN; further

studies should explore other possible channels through which finance may affect economic growth in leading ASEAN countries. Also, the study considers the long-run and short-run effect of without taking into consideration of structural break, therefore, an analysis of a structural break at the cointegrated level would be quite informative. Gregory et al. (1996) examine some of the problems associated with the cointegration test in the presence of structural breaks. They observe that the presence of a structural break often creates spurious unit root in the cointegrating system, emerging to a little power of non-rejection of the null hypothesis of no cointegration. That is, the presence of a structural break test makes it easy to conclude that there is no cointegration. Different types of tests exist for structural breaks at the cointegrated level.

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