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Trade Openness, COVID-19 Shock, Foreign Direct Investment, Inflation, and Output Volatility in Six ASEAN Member States

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Abstract: *This study examines the effect of trade openness and COVID-19 shock on output volatility. Quarterly data from 2010 to 2022 are used, focussing on six Member States within the Association of Southeast Asian Nations (ASEAN). The analysis, conducted through time-series regression, reveals that trade openness had a notable impact on output volatility in most ASEAN Member States, excluding Thailand and Indonesia. Furthermore, it found that the pandemic had an impact on the output volatility of Thailand and the Philippines. Macroeconomic variables were also incorporated, such as foreign direct investment (FDI) and inflation. Under the panel framework, it was found that both variables significantly impacted output volatility. These findings indicate that policymakers should prioritise trade openness and inflation control during uncertain events, such as a global pandemic.*

Keywords: Trade openness; COVID-19 shock; Output volatility; Inflation; FDI

JEL Classification: F10, F14, F17

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1. Introduction

The COVID-19 pandemic has had a significant impact on economic growth and development across the globe. The pandemic and its preventive and containment measures, such as lockdowns and travel restrictions, caused major disruptions to production, supply chains, and global trade (Giroud and Ivarsson, 2020), causing fluctuations in economic growth (i.e. output volatility).

The pandemic affected output volatility through demand-side shocks. With the implementation of lockdown measures, several counties experienced a sharp decline in consumer demand, leading to reduced output and economic activity in sectors that depend on consumer spending, such as travel and tourism (Behsudi, 2020). The pandemic also affected output volatility through supply-side shocks. The disruption of global supply chains and closure of factories and businesses led to a reduction in the availability of raw materials and intermediate goods, causing production delays and increasing costs for businesses (Butt, 2022). Finally, the pandemic led to significant uncertainty and increased risk aversion amongst consumers and investors, resulting in less investment and consumption, leading lower economic activity and output.

Trade openness also causes output volatility to rise. It can expose a country's economy to external shocks because increased trade results in greater exposure to fluctuations in global commodity prices, exchange rates, and demand for exports. Thus, an open economy may experience greater fluctuations in output than a closed economy (Balavac and Pugh, 2016). Trade openness, however, can also reduce output volatility by increasing competition, promoting specialisation, and facilitating access to foreign markets. This is because increased trade can lead to a more diversified economy, reducing dependence on only a few industries or sectors. Specialisation can lead to economies of scale and increased efficiency (Prasad et al., 2005).

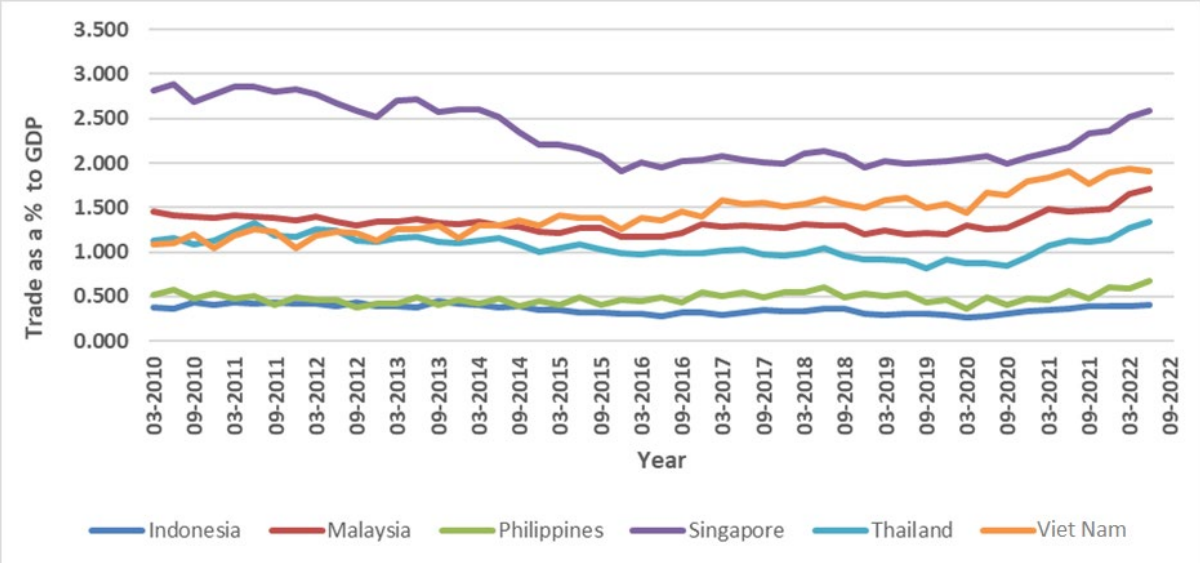
Empirical research on the relationship between trade openness and output volatility is mixed. Some studies have found a positive relationship (e.g. Bejan, 2006; Abubaker, 2015), while others have found a negative relationship or no significant relationship (Cavallo, De Gregorio, Loayza, 2008; Giovanni and Levchenko, 2009). The relationship depends on a country's level of development, nature of trade, and extent of its financial integration.

Given the lack of a consensus on the relationship between trade openness and output volatility, this study aims to investigate the impact of trade openness on output volatility in the Association of Southeast Asian Nations (ASEAN), especially during the COVID-19 pandemic.

No studies have yet examined the effect of trade openness with external shocks – like the COVID-19 pandemic – on output volatility. This study considers six ASEAN Member States (i.e. Indonesia, Malaysia, Philippines, Singapore, Thailand, and Viet Nam, known as the ASEAN-6) as a case study. It is important to know the exact magnitude of the impact of trade openness and the pandemic on output volatility separately and together. By knowing the degree of this impact, countries can make changes to their specialisations in trade during the COVID-19 recovery. For example, if a country can follow a more diversified production structure, then it can mitigate risk, which will reduce aggregate output volatility.

The ASEAN-6 have many similar characteristics and are considered favourable nations for trade openness (Figure 2.1). Singapore has the highest level of trade openness, followed by Malaysia and Viet Nam. However, during the COVID-19 pandemic, trade openness was at a minimum due to closed borders and reduced economic activity.

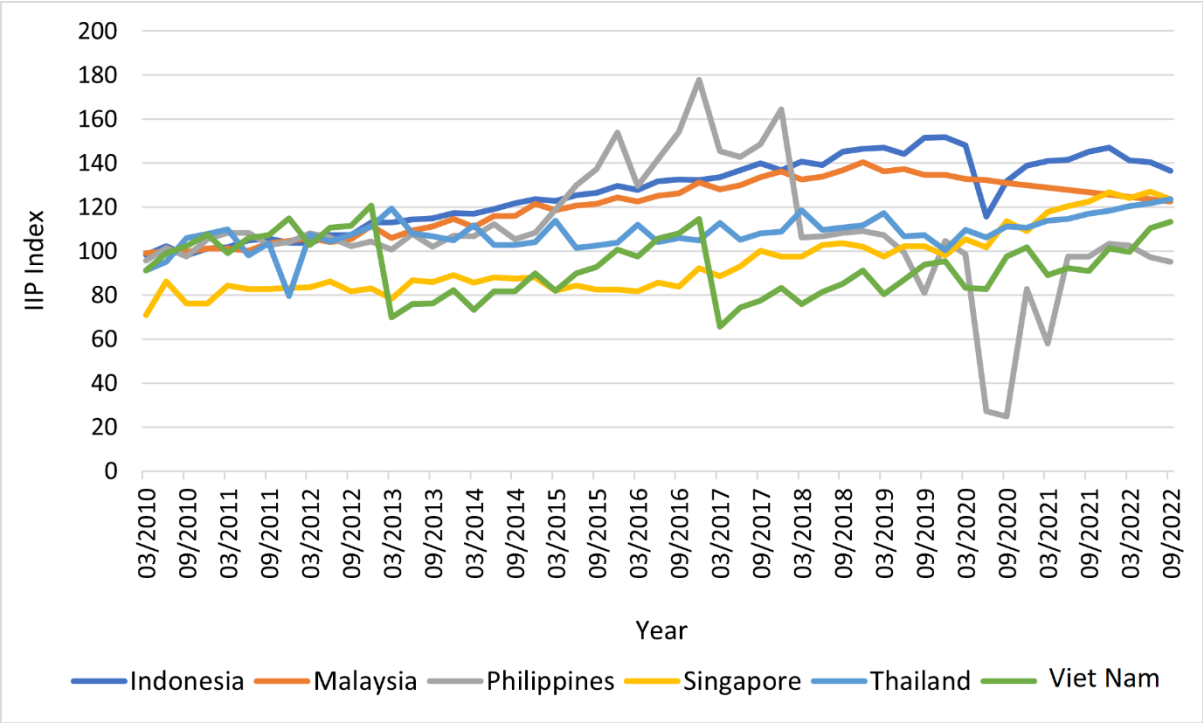
Figure 2.1: Trade Openness in the ASEAN-6
(trade as a % of GDP)



ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product.
Source: World Bank, World Development Indicators, https://databank.worldbank.org/source/world-development-indicators.

Figure 2.2 presents the output of the ASEAN-6. Indonesia has the highest output. The Philippines experienced greater output growth in 2017, but during the COVID-19 pandemic, it was severely impacted, resulting in higher output volatility during that period. Malaysia, Singapore, Thailand, and Viet Nam have exhibited rises in output growth with lower fluctuations in output.

Figure 2.2: Output for the ASEAN 6



ASEAN = Association of Southeast Asian Nations, IIP = Index of Industrial Protection.
Source: World Bank, World Development Indicators, https://databank.worldbank.org/source/world-development-indicators.

The COVID-19 pandemic has interrupted trade flows – not only exports and imports of goods and services but also overall global value chains (GVCs). The change in GVCs during the pandemic affects the forwards and backwards participation of trade for an economy and changes the domestic and foreign components of gross value-added trade to total trade. This change reflects overall trade openness, which eventually affects certain macroeconomic variables. This study revisits the impact of such changes in trade openness due to the GVCs on output volatility using the ASEAN-6 as a sample of nations.

Theoretically, the international trade of goods markets allows countries to specialise in goods with competitive advantages. The reduction in trade barriers (i.e. minimising import tariffs or non-tariff barriers that help increase trade openness) lead to the geographical concentration of industries and export specialisations. Therefore, random non-diversifiable shocks that lead to erratic shifts in exports make output volatility more pronounced as international trade transactions are liberalised (Razin and Rose, 1992).

This study uses macroeconomic variables to examine the impact of trade openness on output volatility. Foreign direct investment (FDI) is a crucial macroeconomic variable that impacts output volatility. Theoretically, FDI affects production processes in a given economy

and helps reduce country-specific shocks that lessen output volatility.[3] Yet studies related to trade openness and output volatility, proxied by the Index of Industrial Protection (IIP) in the Asia-Pacific region, are scant. This study seeks to bridge the research gap in the existing literature.

The contribution of the study is threefold:

(i) First, no study, focussing on the ASEAN region, has yet examined the effects of trade openness on output volatility proxied by the IIP. This study seeks to help policymakers access the magnitude of such an impact and formulate policies accordingly.

(ii) Second, although some studies investigated the effect of trade openness on output volatility, few have explored whether trade openness increases the magnitude of volatility – particularly during a global trade disruption like the COVID-19 pandemic. As policymakers must make corrective actions during unexpected events, this study may help them anticipate them.

(iii) Third, no studies are yet available that take macroeconomic variables into consideration for the ASEAN-6. Macroeconomic variables and their impact on output volatility are useful for policymakers in stabilising the economy.

The next section details the literature review. Section 3 describes the data and methodology. Major findings are discussed in Section 4, while Section 5 features a summary and conclusion.

2. Literature Review

The empirical literature on the relationship between trade openness and macroeconomic volatility is broadly divided into two categories. The first has focussed on the link between trade openness and volatility in crucial macroeconomic variables like output and consumption (e.g. Giovanni and Levchenko, 2009). The second strand examined whether opening trade enables a financial crisis in an economy, thereby creating volatility for key macroeconomic indicators (e.g. Easterly and Kraay, 2000; Cavallo and Frankel, 2008). A recent study by Ma, Jiang, and Yao (2022) also examined the impact of trade openness and financial openness on macroeconomic volatility in China.

[3] Barrell and Gottschalk (2004) found that the impact of FDI on output volatility is not statistically significant. Thus, the nexus between FDI and output volatility must also be studied. Similarly, inflation could be a factor that significantly affects output volatility (Wolf, 2003; Wu and Rapallo, 1997). Inflation may have a positive impact on output volatility. A plethora of studies have also focussed on trade openness and gross domestic product (e.g. Sarkar, 2008; Ramzan et al., 2019; Fatima et al., 2020).

As global trade has experienced exponential growth, trade openness has played a role in increasing the volatility of output (Rodrik, 1997). Newbery and Stiglitz (1984) – in a seminal work – highlighted the importance of trade openness for changes in output volatility in individual sectors of an economy. If an individual sector is more open to international trade, then an industry within that sector is more vulnerable to global supply and demand shocks.

Several studies have also focussed on trade openness and gross domestic product (GDP) (e.g. Fatima et al., 2020). Sarkar (2008) found that trade openness significantly impacts growth in rich and highly trade-dependent countries but that region-level analysis has had mixed responses. Using cross-country panel data of 51 less-developed countries, he found that trade openness had positive and significant relationships in middle-income countries but no relationship in East Asia. Similarly, Ramzan et al. (2019) found the existence of a non-linear pattern between trade openness and GDP growth when total factor productivity is taken into consideration. They used a balanced panel of 82 country data from 1980 to 2014. Using system GMM, they found the existence of an indirect relationship between trade openness and GDP when human capital accumulation is considered.

Finally, there is some literature that focussed on trade openness and GDP volatility (e.g. Nguyen and Bui, 2021; Ma et al., 2022). Bejan (2006) found that trade openness causes more output volatility in developing countries than in developed ones. Giovanni and Levchenko (2009), Abubaker (2015), and Kim et al. (2016) found that sectors open for international trade and specialisation cause aggregate output volatility. However, Haddad et al. (2013) and Balavac and Pugh (2016) noted that countries with diverse export baskets have a negative relationship with output volatility. Finally, Mireku, Animah Agyei, and Domeher (2017) found that short- and long-term economic growth volatility cause a change in the degree of trade openness.

3. Data and Empirical Approach

This study uses quarterly data from 2010 to 2022 for the analysis. Data, related to total exports, total imports, IIP, FDI, and inflation, were collected on a quarterly basis for the ASEAN-6 from the CEIC Database.[4] Trade openness is measured as (Export + Import)/GDP. Further, an interaction variable was created by taking trade openness multiplied by the number of COVID-19 confirmed cases to see how they together impact output volatility. The necessary conversion methods are applied to make most of the variables unit-free.

[4] ISI Emerging Markets Group, CEIC Database, https://www.ceicdata.com/en

To examine the research objective, the study uses both time-series data and panel data and compares the results for each ASEAN-6 country and as a group. Three models are run:

$$Volatility_{it} = \alpha_0 + \alpha_1 Output_{it} + \beta_1 TO_{it} + u_{it} \quad (1)$$

$$Volatility_{it} = \alpha_0 + \alpha_1 Output_{it} + \beta_1 TO_{it} + \gamma_1 COVID-19_t + \gamma_2 TO_{it} * COVID-19_t + u_{it} \quad (2)$$

$$Volatility_{it} = \alpha_0 + \alpha_1 Output_{it} + \beta_1 TO_{it} + \gamma_1 COVID-19_t + \gamma_2 TO_{it} * COVID-19_t + \gamma_3 FDI_{it} + \gamma_4 Inf_{it} + u_{it} \quad (3)$$

where *Volatility* is the variance of the log of IIP, and *Output* refers to the log of IIP at a level that can be treated as a control variable. *TO* refers to trade openness, and COVID-19 confirmed cases, FDI, and inflation (*Inf*) are considered. $TO_{ijt} * COVID-19_t$ is the interaction effect between COVID-19 confirmed cases and trade openness. α, β, and γ are the unknown coefficients to be estimated. Finally, *i* refers to country, *t* refers to time, and *u* is an error term that follows IID $(0, \sigma^2)$. The equations (1), (2), and (3) are estimated using time-series and panel data analysis. All core variables are checked for stationarity, cross-dependency, and endogeneity. Then, appropriate econometrics tools such as ordinary least squares (OLS) regression and appropriate panel data models are used.

4. Major Findings

The regression test results for the ASEAN-6 are provided in Table 1. The study observes that in most countries, except Singapore, output had a significant and positive impact on volatility. Furthermore, in Malaysia, the Philippines, and Viet Nam, trade openness had an unfavourable impact on output volatility, likely due to reduced economic activity caused by the COVID-19 pandemic. In contrast, in Thailand, trade openness had a positive and negligible impact on output volatility. Trade openness in the Philippines had a negative and statistically significant impact on output volatility.

Table 1: Regression Test Results

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Constant	0.028*	0.026*	–0.011	0.037*	0.011*	0.000
	(0.00)	(0.00)	(0.70)	(0.00)	(0.00)	(0.75)
Output	–0.013*	–0.012*	0.007	–0.018*	–0.005*	0.002***
	(0.00)	(0.00)	(0.60)	(0.00)	(0.00)	(0.09)
Trade openness	–0.000	–0.002*	–0.086**	0.005*	0.001	–0.005*
	(0.70)	(0.00)	(0.01)	(0.00)	(0.88)	(0.00)

Note: *, **, and *** indicate 1%, 5%, and 10% levels of significance, respectively. Probability values are in parenthesis.
Source: Authors.

Next, the COVID-19 pandemic is included, and the regression results are presented in Table 2. The findings indicate that, for Thailand, the COVID-19 pandemic had a negative impact on output volatility. Further, the interaction variables are found to have no effect on output volatility. The COVID-19 pandemic affected output volatility adversely in the Philippines and Thailand. Indonesia, Malaysia, Singapore, and Viet Nam saw insignificant impacts from the COVID-19 pandemic.

Table 2: Regression Test Results with COVID-19 Pandemic

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Constant	0.026*	0.020*	–0.099*	0.026*	0.006*	–0.000
	(0.00)	(0.00)	(0.00)	(0.00)*	(0.00)	(0.83)
Output	–0.012*	–0.009*	–0.028**	–0.013*	–0.002*	0.002*
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)
Trade openness	–0.001	0.003***	–0.002	0.007*	0.000	–0.005*
	(0.41)	(0.09)	(0.94)	(0.00)	(0.38)	(0.00)
COVID-19	0.000	-0.000	–0.008*	–0.000	–0.000*	–0.000
	(0.49)	(0.74)	(0.00)	(0.48)	(0.00)	(0.12)
Interaction dummy	0.000	-0.000	–0.011	–0.000	–0.000	0.000
	(0.33)	(0.27)	(0.25)	(0.66)	(0.92)	(0.28)

Note: *, **, and *** indicate 1%, 5%, and 10% levels of significance, respectively. Probability values are in parenthesis.
Source: Authors.

A panel regression is then conducted on equation (1), and the outcomes are documented in Table 3. The analysis shows that both output and trade openness have significant and negative effects on output volatility in both the fixed and random effect models. The possible reasons are threefold. First, when countries like the ASEAN-6 become more open to trade, external shocks – such as changes in global demand or supply – can result in greater fluctuations in output and greater uncertainty for domestic products, which can, in turn, lead to greater volatility in output. Second, increased trade openness can also lead to greater competition for domestic products, particularly in industries where the countries do not have comparative advantages. This can lead to firms being forced to cut costs and to reduce output, particularly during periods of low demand, hence negative output volatility. Finally, trade openness can also lead to greater capital flows into and out of a country, which can result in greater exchange rate volatility. This can affect the competitiveness of domestic firms and lead to greater volatility in output.

Table 3: Panel Fixed and Random Effect Models

	Fixed Effect	Random Effect
Constant	0.053*	0.053*
	(0.00)	(0.00)
Output	–0.022**	–0.022*
	(0.01)	(0.00)
Trade openness	–0.001*	–0.001*
	(0.00)	(0.00)

Note: * and ** indicate 1% and 5% levels of significance, respectively. Probability values are in parenthesis.
Source: Authors.

After incorporating the COVID-19 and interaction variables, panel regression analysis is then conducted (Table 4). The findings indicate that, in the random effect model, the COVID-19 pandemic had a statistically significant and negligible impact on output volatility. Moreover, trade openness is found to have an adverse impact on output volatility under both fixed and random effect models. These findings are largely consistent with those obtained through the time-series analysis, with only a few exceptions. It is further observed that the COVID-19 pandemic had statistically significant but negligible impact on output volatility.

Table 4: Panel Fixed and Random Effect Models with COVID-19 Pandemic

	Fixed Effect	Random Effect
Constant	0.054*	0.055*
	(0.00)	(0.00)
Output	–0.023**	–0.022*
	(0.01)	(0.00)
Trade openness	–0.002*	–0.002*
	(0.00)	(0.00)
COVID-19	–0.000	–0.000*
	(0.86)	(0.00)
Interaction variable	–0.000	–0.000
	(0.25)	(0.28)

Note: * and ** indicate 1% and 5% levels of significance, respectively. Probability values are in parenthesis.
Source: Authors.

Next, an analysis using macroeconomic variables in equation (3) is conducted (Table 5). Trade openness is found to have a negative effect on output volatility in Indonesia,

Singapore, Thailand, and Viet Nam – but a positive effect in Malaysia. The COVID-19 pandemic had a positive impact on output volatility in Indonesia and a negative impact in the Philippines and Thailand. The interaction dummy had a mixed response on output volatility, with a positive impact in Indonesia and a negative impact in the Philippines. Similarly, inflation had mixed effects (i.e. both positive and negative) on output volatility. FDI had a negative impact on output volatility only in Viet Nam. Inflation had mixed impacts on output volatility across the ASEAN-6, while FDI negatively affected output volatility in Viet Nam.

Table 5: Regression Results with Macroeconomic Variables

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Constant	0.037*	0.034*	–0.343*	0.003*	0.019*	0.007**
	(0.00)	(0.00)	(0.00)	(0.57)	(0.00)	(0.04)
Output	–0.012*	0.003	–0.037*	–0.014*	–0.001*	0.003*
	(0.00)	(0.40)	(0.00)	(0.00)	(0.00)	(0.00)
Trade openness	–0.004*	0.006*	–0.021	0.010*	–0.001*	–0.002**
	(0.00)	(0.00)	(0.40)	(0.00)	(0.00)	(0.01)
COVID-19	0.000**	0.000	–0.010*	–0.000	–0.000*	–0.000
	(0.01)	(0.74)	(0.00)	(0.24)	(0.00)	(0.43)
Interaction	0.001*	–0.000	–0.008	–0.001**	0.000	0.000
dummy	(0.00)	(0.50)	(0.20)	(0.01)	(0.92)	(0.88)
FDI	–0.000	–0.000	0.001	–0.000	–0.000	–0.002**
	(0.45)	(0.87)	(0.59)	(0.19)	(0.97)	(0.01)
Inflation	–0.004*	–0.020*	0.231*	0.013*	–0.008*	–0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.46)

FDI = foreign direct investment.
Notes: * and ** indicate 1% and 5% levels of significance, respectively. Probability values are in parenthesis.
Source: Authors.

Panel fixed and random effect models are then applied to macroeconomic variables (Table 6). The analysis reveals that trade openness had a negative impact on output volatility and that the COVID-19 pandemic had a negative impact on output volatility in both the fixed and random effect models. It is evident that any unwanted shocks to the economy inevitably affect output volatility. Nevertheless, a positive impact of interaction variables on output in both models is found. Some discrepancies in the findings are also observed. For instance, FDI and inflation had a positive and significant impact on output volatility in the fixed effect model

but a negative impact in the random effect model. Mixed responses of FDI and inflation on output volatility across models are also found.

Table 6: Panel Fixed and Random Effect Models with Macroeconomics Variables

	Fixed Effect	Random Effect
Constant	0.034**	0.019*
	(0.02)	(0.00)
Output	–0.006	–0.031*
	(0.13)	(0.00)
Trade openness	–0.012*	–0.023*
	(0.00)	(0.00)
COVID-19	–0.001*	–0.000**
	(0.00)	(0.05)
Interaction variable	0.001*	0.003*
	(0.00)	(0.00)
FDI	0.001***	–0.005*
	(0.06)	(0.00)
Inflation	0.341*	–0.496*
	(0.10)	(0.00)

FDI = foreign direct investment.
Note: *, **, and *** indicate 1%, 5%, and 10% levels of significance. Probability values are in parenthesis.
Source: Authors.

As a result of receiving mixed feedback from the time-series regressions and recognising certain limitations of panel fixed and random methods, panel corrected standard errors are then used to produce more reliable outcomes (Table 3.7). These results indicate that trade openness had an adverse effect on output volatility – a finding discussed earlier. Moreover, the COVID-19 pandemic had both a significant and insignificant impact on output volatility. Only the Philippines was significantly affected by the COVID-19 pandemic.

The interaction of pandemic and trade openness is found to have had a positive impact on output volatility. The impact of FDI on output volatility is both statistically significant but negligible. The reasons for this outcome could be competition and efficient allocation of resources. The entry of foreign firms through FDI could result in competition with domestic companies, which may lead to a decrease in output and an increase in volatility. Additionally, FDI could cause resource misallocation if it diverted resources from the domestic economy's productive sectors to foreign-owned enterprises. This shift could lead to a reduction in output and an increase in volatility.

Next, inflation had a statistically significant and negative impact on output volatility. The reasons could be uncertainty, reduced purchasing power, and input cost. High inflation could lead to uncertainty in the economy, which could cause businesses and investors to become hesitant about new investments, resulting in lower output and increased volatility. Further, high inflation could reduce the purchasing power of consumers, which could lead to lower demand for goods and services, or negative volatility. Finally, inflation could create higher input costs for businesses, such as higher wages or raw material costs. This could spur lower profits and reduced investment, resulting in lower output and increased volatility. From Table 7, all variables are statistically significant and have negative impacts on output volatility, except the interaction variable.

Table 7: Panel Corrected Standard Errors with Macroeconomics Variables

	Panel Corrected Standard Errors
Constant	–0.193*
	(0.00)
Output	–0.031*
	(0.00)
Trade openness	–0.023*
	(0.00)
COVID-19	–0.000**
	(0.02)
Interaction variable	0.003*
	(0.00)
FDI	–0.005*
	(0.00)
Inflation	–0.49*
	(0.00)

FDI = foreign direct investment.
Note: * and ** indicate 1% and 5% levels of significance, respectively. Probability values are in parenthesis.
Source: Authors.

5. Conclusion

The study results show that output had a significant and positive impact on volatility in most countries, except Singapore, where it had a negative impact. Additionally, the study reveals that trade openness had an unfavourable impact on output volatility in Malaysia, the Philippines, and Viet Nam. In Thailand, it had a positive impact on output volatility. The negative impact could be assigned to external shocks, competition, and/or fluctuations in capital flows.

Moreover, the study reveals that the COVID-19 pandemic had a detrimental effect on output volatility in Thailand because of economic uncertainty. The interaction variable did not have a significant impact on output volatility for the six ASEAN countries, however. Applying a panel regression model, the study did find that the COVID-19 pandemic had a significant and negative impact on output volatility under the random effect model. Trade openness had a negative impact on output volatility under both the fixed and random effect models.

Finally, using panel corrected standard errors, it is found that trade openness, COVID-19, FDI, and inflation negatively affected output volatility in ASEAN-6. The possible reasons include external shocks, economic uncertainty, competition, and/or reduced purchasing power.

Policymakers should thus take corrective measures during uncertain events, as they have the potential to create devastating impacts on output volatility. Furthermore, trade openness mostly contributes negatively to output volatility; policymakers are advised to minimise the impact of external shocks on output volatility. As FDI failed to yield positive results on output volatility because of competition, policymakers should control inflation during uncertain events like global pandemics.

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